PLANT VARIETY PROTECTION IN THAILAND

by

TANIT CHANGTHAVORN

A Thesis Submitted for the Degree of Doctor of Philosophy

Queen Mary and Westfield College

University of London

May 1998

ABSTRACT

The Government of Thailand decided recently to introduce a legal system for the protection of plant variety right (PVR) in order to meet its commitment under the TRIPs agreement (part of the WTO agreement) to protect new varieties of plants. Having taken this significant decision - although in reality the decision was probably little more than a formality because of the TRIPs commitment - the government must assess the likely impact of PVR on public and private interests in Thailand and, in the light of that assessment, construct a PVR system suited to the country's particular needs (so far as these can be envisaged). The likely impact of the government's decision and the choice to be made constitute the backbone of this thesis as well as its prime focus.

A PVR system is intended primarily to promote invention and innovation in the field of plant breeding. Whether the availability of PVR in Thailand will achieve those objectives cannot be said at this point. Studies carried out in countries with mature PVR systems claim, despite the lack of any solid evidence on which to found the claims, that PVR systems have certain positive or beneficial effects, for example more varieties giving higher yields and better adapted to growing conditions. On the other hand, some commentators believe that these benefits result from other factors, in particular technological advances (for example, improvements in cultivation and management of commercial crops).

This thesis concludes that the availability or grant of PVR in Thailand will not have any radical impact on public and private interests there. At present, plant breeding and seed production are carried out by public and private sectors. Available data

on seed production and consumption indicate the need for more investment in plant breeding and seed production, particularly in the private sector. A PVR system is unlikely to encourage breeders or producers to invest more because the availability of PVR is not a vital determinant in investment decisions. Fortunately, as far as can be seen at present, a PVR system is unlikely to have negative effects, e.g. seed price rises, obstacles to technological development or environmental dangers. In considering the most appropriate system, the major factors to be assessed are economic impact, existing political commitment, and practicality. The government should adopt the system established by the 1978 UPOV Convention, in preference to the 1991 Convention, because the earlier Convention is the more appropriate for Thailand's developmental needs.

TABLE OF CONTENTS

Chapter 2 Plant variety right protection

Chapter 3 Rationales behind the introduction of plant variety protection in Thailand

Chapter 4 Legal protection for plant varieties in Thailand and TRIPs plant variety protection

Chapter 5 Plant breeding and seed production in Thailand: their current status and future

ACKNOWLEDGEMENT

This thesis is dedicated to my parents who have supported and encouraged me with all their heart before and throughout my research. I must express my gratitude to my supervisors, Dr. Noel J. Byrne and Ms. Alison Firth, for their unfailing support and encouragement and for giving me the benefit of their experience. I am most grateful for the generous financial support I have received from the government of Thailand. I have a special debt to acknowledgement to Mrs. Ellen Gredley for her courtesy, patience and assistance in locating and bringing to my notice materials relevant to my research and for her editorial assistance.

I also acknowledge and thank the following:

- National Centre for Genetic Engineering and Biotechnology, Thailand for granting me the study leave that made it possible for me to embark upon this programme of research.

- Mr. Philip K. Hunter and Mr. Jonathan D. Hardisty for their friendship and editorial assistance.

- Staff in the Intellectual Property Law Unit, Ms. Swee Ng, Ms. Gina Hickey and Mrs. Vera Garner for their assistance.

- My fellow Ph.D. candidates in the Intellectual Property Law Unit: in particular Dr. YunJoo Lee, Mr. Spyros Maniatis, Ms. Uma Suthersanen, Dr. Lim Heng Gee, Mr. Ching Wen Yang and Mr. Ong Chui Koon for their good friendship.

GENERAL INTRODUCTION

Background

Intellectual property protection has in many countries been significantly influenced by the inclusion of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) within the Agreement Establishing World Trade Organisation (WTO).[1,2] TRIPs requires member States to bring their intellectual property laws and practices to an agreed level of uniformity.[3]

Following the ratification of the WTO agreement in 1994, the Thai government announced plans to improve its intellectual property laws in order to ensure

---

[1]The TRIPs agreement is one of the multinational trade agreements annexed to the WTO Agreement, and as such forms part of the package that has to be accepted by all members of the WTO. (*Intellectual Property & International Trade: A Guide to the Uruguay Round TRIPs Agreement,* International Chamber of Commerce, World Business Organisation, Paris, 1996, p.10.)

[2]The existing international conventions on intellectual property rights, in particular the Paris Convention, the Berne Convention for the Protection of Literary and Artistic Works, the Rome Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organisations and the Washington Treaty on Intellectual Property in Respect of Integrated Circuits, do not provide sufficient protection against adverse effects of trade distortions. In addition, they provide neither for effective enforcement nor for dispute settlement mechanisms. The TRIPs agreement fills these loopholes (*Intellectual Property & International Trade: A Guide to the Uruguay Round TRIPs Agreement,* International Chamber of Commerce, World Business Organisation, Paris, 1996, p. 18.)

[3]The TRIPs agreement is divided into seven parts: general provisions and basic principles; standards concerning the availability, scope and use of intellectual property rights; enforcement of intellectual property rights; acquisition and maintenance of intellectual property rights and related interpartes procedures; dispute prevention and settlement; transitional arrangements and institutional arrangements and final provisions.

compliance with TRIPs obligations.[4] Amongst these plans is the proposal for legislating plant variety right (PVR) protection, and this proposal has produced mixed reactions from interested groups in the country.

These reactions have prompted the author to investigate whether the introduction of PVR protection, notwithstanding the fact that the country must meet its TRIPs obligations, will benefit Thailand's main economic interests in relation to plant breeding and seed production. At the same time, it is necessary to examine whether the protection will have undesirable consequences.

Objective, scope and methodology of thesis

As well as addressing the above issues, this thesis proposes an appropriate PVR system for Thailand. For this purpose, a wide array of information has been collected and analysed. The research methodology is based on the use and analysis of documents, in conjunction with a survey. This involves reliance on wide ranging sources, including legal literature, legislative reports and consultation documents, and reported judicial decisions from countries with mature PVR systems.

A concise and simple survey questionnaire was designed and posted to the selected individuals, with the intention that the respondents could prepare themselves for a

---

[4]In May 1995, the Thai Department of Intellectual Property announced that they were drafting a series of new laws on legal protection for plant varieties, integrated circuits and industrial designs, as well as amendments to the Thai Patent Law to permit its ratification of the Patent Cooperation Treaty. (Blakeney, M. "The Impact of the TRIPs Agreement in the Asia Pacific Region" [1996] 10 European Intellectual Property Review 544, at 552.)

subsequent interview.[5] Targeted informants included business executives and decision makers in seed companies and governmental research organisations. Interviews took place either by telephone or face to face where possible and convenient. Part of the time allocated for an interview was necessarily spent offering basic information on the subject of PVR protection and attempting to correct any misconceptions.

Outline

Apart from the general introduction and conclusion, this thesis consists of three main parts. The first part comprises two chapters which attempt to equip readers with basic scientific and legal knowledge for PVR protection. The complex nature of PVR protection can be a problem for lawyers who have to deal with this issue. Chapter 1 simplifies technical matters of plant breeding and seed production. Chapter 2 summarises the history of plant variety protection and gives the main features of PVR systems, their administration and the rights involved.

The second part aims to verify the government's decision on the introduction of PVR protection. The rationale behind the introduction of PVR protection and its economic and political justifications are assessed in Chapter 3. Following this, it must be asked whether legal protection for plant varieties is at present available in Thailand and this question is addressed in Chapter 4.

The final and main part of the thesis deals with private and public-interest aspects of PVR protection. Chapter 5 focuses on the main economic interests of

[5]The main reason for selecting this approach is the low rate of a good response, i.e. the returned data questionnaires, particularly from business executives with busy schedules.

commercial plant breeding and seed production in Thailand. Towards this end. the chapter discusses the present state of the Thai economy, agricultural production and marketing, plant breeding and seed production, and the current status of plant biotechnology. Chapter 6 confronts the important question whether PVR protection will encourage the main economic interests identified in the previous chapter. Chapter 7 deals with public-interest issues of PVR protection. In these two chapters, attention is drawn to empirical studies of the effects of PVR protection and other relevant documents.

CHAPTER 1

BASIC SCIENTIFIC KNOWLEDGE FOR PLANT VARIETY RIGHT

Introduction

A plant variety right (PVR) system is meant to encourage the development of new plant varieties by giving exclusive rights in such varieties to those who breed or develop them. The system was created by plant breeders for plant breeders, and to understand it properly one needs to have a firm grasp of the science and techniques that underpin it. This can be a problem for lawyers, whether academic or practitioner, who may find they are excluded from the topic of PVR because they lack any, or a sufficient, understanding of plant breeding (including its scientific basis), its possibilities and its limitation; and the concern of this chapter is to remedy that deficiency. The subject is highly complex and is of necessity treated by this chapter in a simplified manner.

1.1. What are plants?

Plants, both the simple and the exotic, are many things to humankind and other living creatures. Cultivated plants can be food for us and our animals; they can provide us with medicine, clothing, and shelter. They can be beautiful and dangerous, often at one and the same time, such as roses which have thorns on the stems. Quite simply, life as we know it could not exist without plants.

1.1.1. Nature of plants

Humans and plants have a long-term relationship. A person who is not a biologist or botanist may see plants as living organisms with green leaves, stems, fruits, flowers and roots, but of course plants are much more than that. A plant is a living organism capable of using chlorophyll (a green pigment found mainly in plants) to transform the energy of sunlight into stored potential energy (this process is known as photosynthesis). Humans have known about plants for as long as they (humans) have existed, but they have not necessarily understood them. For example, few people know that some organisms, which lack chlorophyll but morphologically are very similar to certain groups of the lower chlorophyll plants, are included in the plant kingdom. Therefore, the concept that all plants must have green leaves, stems, roots and flowers is not scientifically correct. Amongst exceptions to the common view of plants are, for instance, cacti which are classified as plants even though they do not appear to have leaves. Mosses, with what appear to be leaves and stems, and fungi such as mushrooms (they produce spores which function as

seed), are easily mistaken as plants, but are excluded from classification as plants on the basis of the differences in a number of basic biochemical respects.[1]

Table 1.1 Main parts of plant and their functions[2]

Part	Function
Roots	To anchor plant in ground; to absorb water and mineral salts for the rest of the plant
Stems	To support leaves, flowers, etc; passage for vascular tubes
Leaves	To manufacture food for plant; to give off excess water; to effect exchange of gases for the plant
Flowers	Contain reproductive organs of plants. In some instances, attract insects to ensure pollination
Fruit	Womb of the seed; provides protection for seed
Seed	Contain unborn plant (embryo) which will develop into new plant under suitable conditions, and food store
Vascular system	Bundles of tubes, which conduct water and salts upward from the roots and carry dissolved food from leaves to other parts of plant

The notion of "plant" is important for the functioning and effectiveness of a PVR system. With the scientific definition of a plant being somewhat ambiguous, it may fall to the lawyer to decide whether a commonsense notion of plant should prevail over the botanical concept in any case where scientific opinion cannot agree whether or not organism in question is a plant.

---

[1]Mauseth, J.D. *An Introduction to Plant Biology*, Saunders College Publishing, Philadelphia, 1991, p. 2.

[2]This table is from Hanauer, E.R. *Biology Made Simple*, W.H. Allen, London, 1980, p. 79.

1.1.2. Plants at the molecular level

1.1.2.1. Plant cells

All living organisms consist of one or more cells which are the basic units of life. Cells have been recognised for more than three centuries; however, the nature of cells first began to be understood when Robert Hooke found a network of tiny boxlike compartments in a thin slice of cork using magnifying lenses.[3] He named these tiny compartments "cellulae", or in English "cells". A cell is not only a basic structural unit of all organisms but also a basic unit of reproduction.

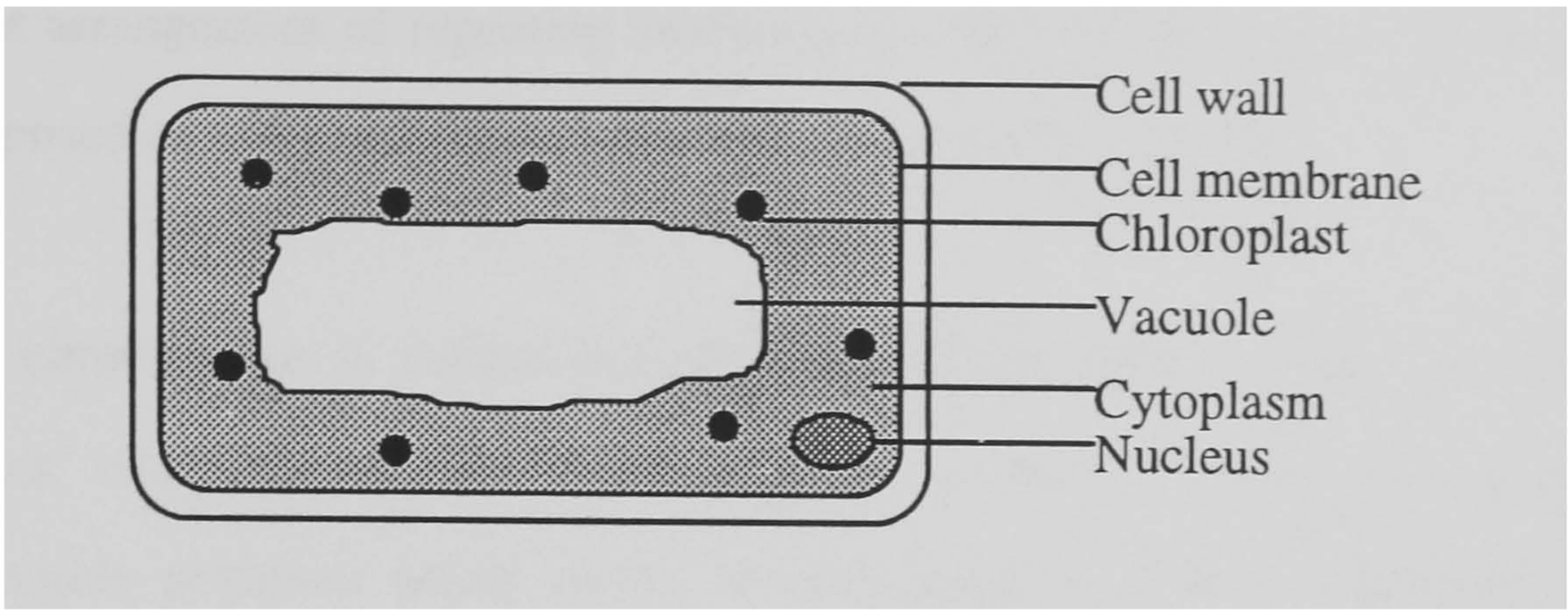
Cells come in various sizes, shapes and forms; some of the smallest cells, for instance, are only 0.2-0.3 thousandths of a millimetre in diameter whilst birds eggs which are indeed single cells can be seen by the naked eye.[4] Cells have unique structures which perform different functions.

---

[3]De Robertis, E.D.P. et al. *Cell and Molecular Biology*, 8th ed., Lea & Febiger, Philadelphia, 1987, p. 5.

[4]Becker, W.M. et al. *The World of the Cells*, 2nd ed., Benjamin/ Cummings, California, USA, 1991, p. 74.

Fig 1.1 Plant cell structure



(1) **Cell membrane** - the outer surface of the cell protoplasm or cytoplasm. Its function is to regulate the passage of liquids and gases into and out of the cell.

(2) **Cytoplasm** - its function is to carry on all the activities of metabolism.

(3) **Nucleus** (a definite structure within the cytoplasm of every cell) - its function is to control the activities of the cell, especially the function of cell division.

(4) **Chromosome** (a thread-like bodies within the nucleus) - its function is to determine the inheritance or heredity of characteristics from one generation to another.

(5) **Cell wall** (outer hard substance which surrounds the soft cell) - its function is to protect the cell.

(6) **Chloroplast** (the green pigment or chlorophyll bearing bodies) - it plays a vital role in the generation of energy.

1.1.2.1.1. Cell genetic structure

Located in the cell nucleus, "chromosomes" are characteristic of living organisms. A chromosome is a long single continuous chain of chemicals called "deoxyribonucleic acids" (DNA).[5] (See Fig 1.2) A DNA molecule consists of two strands that wrap around each other to resemble a twisted ladder whose sides, made of sugar and phosphate molecules, are connected by rungs of nitrogen-

---

[5]DNA is a double-stranded molecule held together by weak bonds between base pairs of nucleotides. The four nucleotides contain the bases: adenine (A), guanine (G), cytosine (C), and thymine (T). In nature, base pairs form only between A and T and between G and C.

containing chemicals called nitrogenous bases.[6] (See Fig 1.2) Each strand is a linear arrangement of repeating similar units called "nucleotides", which are each composed of one sugar, one phosphate, and a nitrogenous base.

If a chromosome is demarcated along its length, what we get are numerous "genes" which are the basic physical and functional units of heredity. A gene is a nucleotide sequence which carries the biological or genetic information.[7] Each gene has its unique nucleotide sequence which contributes to the distinctive activity of a cell.[8] A gene is analogous to a "blue print" in mechanical engineering. During the process of sexual reproduction, genes are transmitted from parents to their offspring. The biological information is transmitted by the mixing of genetic information from two parent organisms and results in offspring that are genetically dissimilar, both from each other and from the parents as explained in Mendel's experiments. (See Fig 1.3) Mendel undertook his experiments by breeding a garden pea. He was able to determine the distinctive units of genetic inheritance that existed. His discovery is fundamental to a new science called genetics.

---

[6]Stryer explains that DNA consists of two interlocking spiral ribbons, each comprising a backbone of sugar and phosphate molecules with a series of nitrogenous bases jutting inwards like the teeth in a zipper. (Stryer, L. *Biochemistry*, 3rd ed., W.H. Freeman, New York, 1988, p. 88.)

[7]A gene is an ordered sequence of nucleotides located in a particular position on a particular chromosome that encodes a specific functional product.

[8]This involves a process called "gene expression" by which a genetic information is converted into the structures present and operating in the cell.

Fig 1.2 Chromosome - DNA (This picture is based on Gardner, E.J. et al. *Principles of Genetics,* 8th ed., John Wiley & Sons, New York, USA, 1991.)

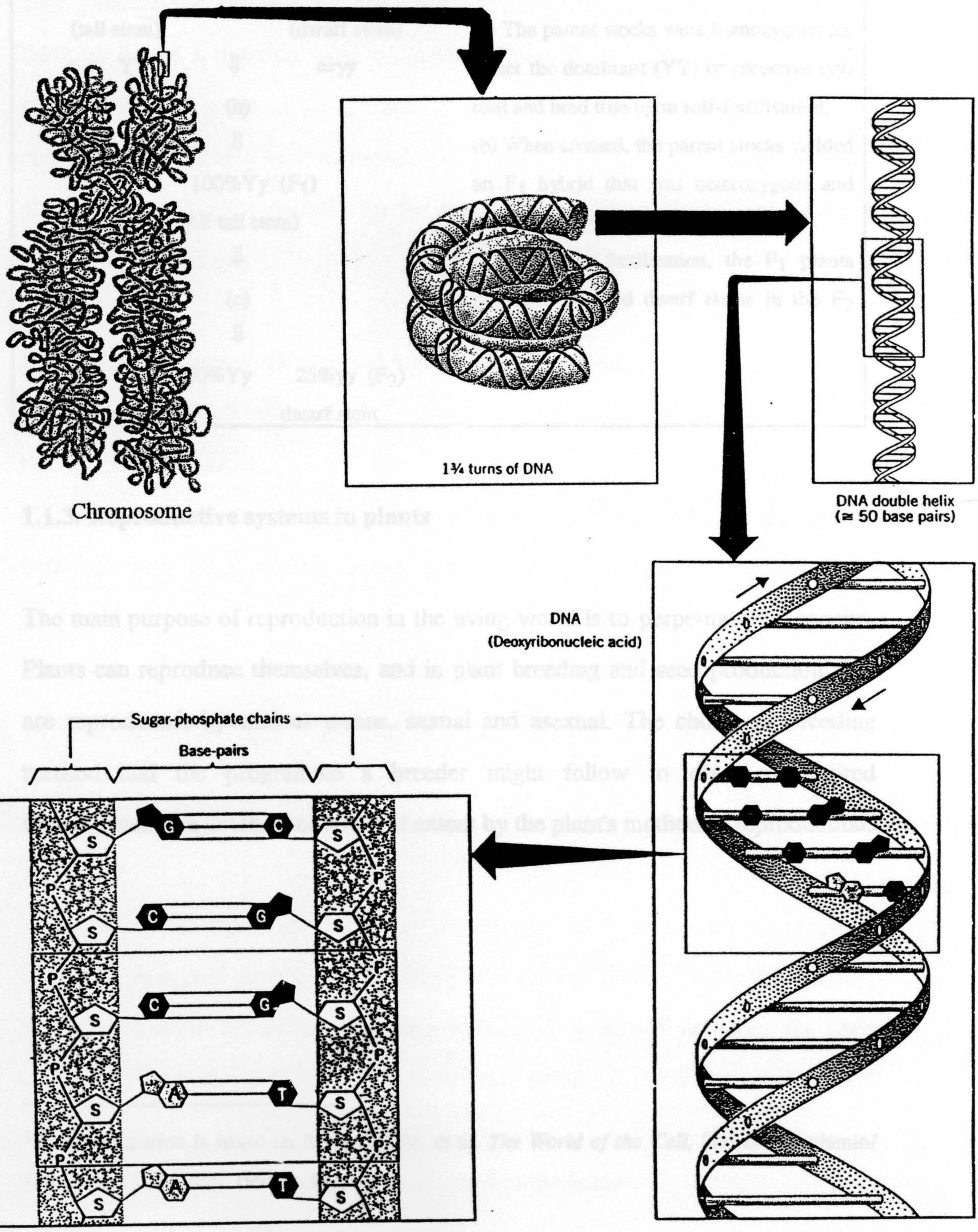
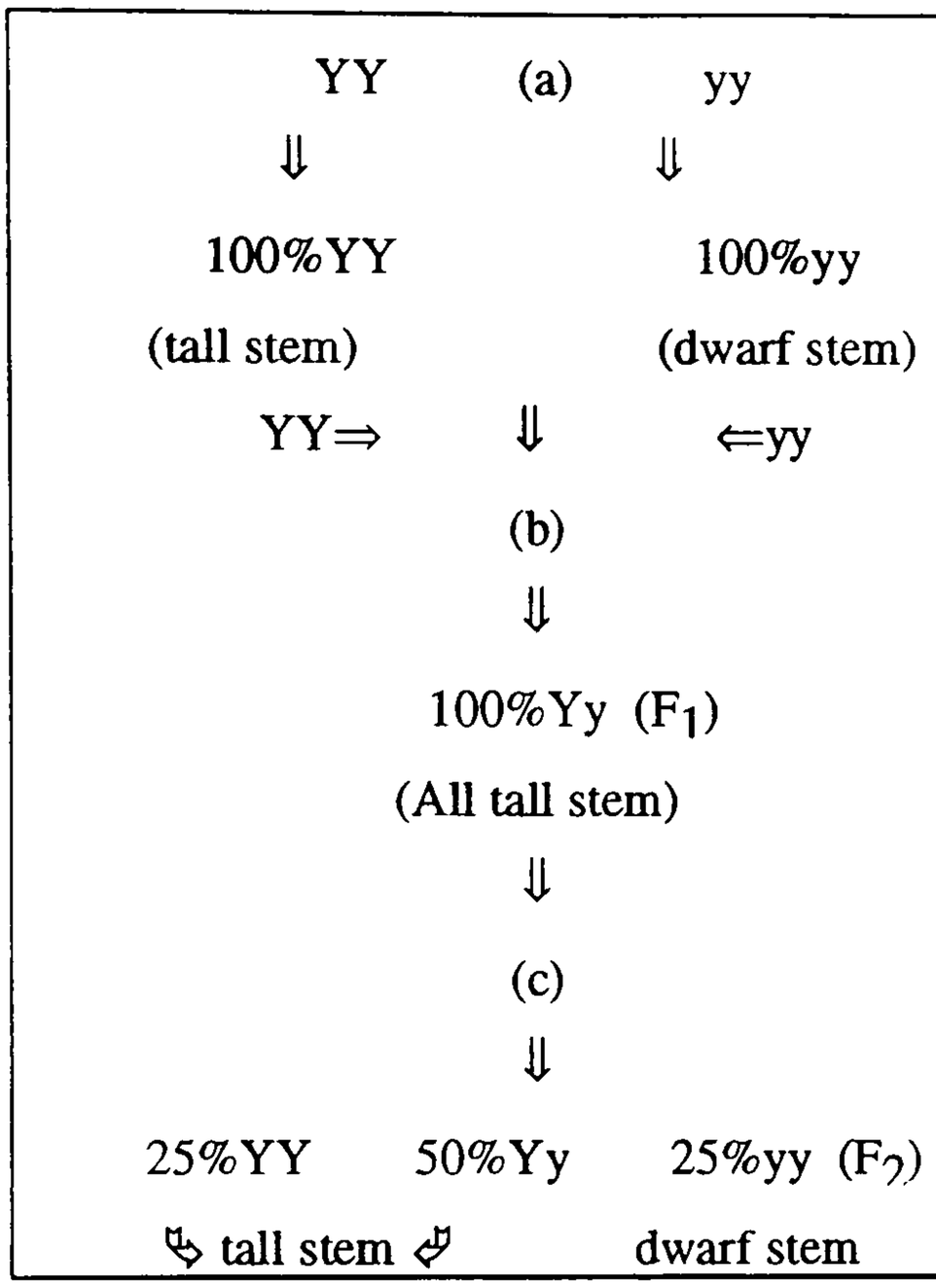


Fig 1.3 The Mendel's experimental approach: Transmission of genes controlling traits[9]



Genetic crosses were made with peas having either tall (Y, dominant) or dwarf (y, recessive) stems.

(a) The parent stocks were homozygous for either the dominant (YY) or recessive (yy) trait and bred true upon self-fertilisation.

(b) When crossed, the parent stocks yielded an F_1 hybrid that was heterozygous and therefore showed the dominant trait.

(c) Upon self-fertilisation, the F_1 plants produced tall and dwarf stems in the F_2 generation.

1.1.3. Reproductive systems in plants

The main purpose of reproduction in the living world is to perpetuate the species. Plants can reproduce themselves, and in plant breeding and seed production they are reproduced, by various means, sexual and asexual. The choice of breeding method and the programme a breeder might follow to obtain a desired improvement are determined to some extent by the plant's method of reproduction.

---

[9]This information is based on Becker, W.M. et al. *The World of the Cell*, 2nd ed., Benjamin/ Cummings, California, 1991, p. 441.

1.1.3.1. Sexual reproduction

Sexual reproduction in plants results from the interaction between a male cell (a male gamete) and a female cell (an egg cell). The result of sexual reproduction is the creation of a massive array of genetic diversity; in other words, in sexual reproduction the genes of the parents (a male gamete and an egg cell) are mixed and from the resulting seed a diversity of offspring is produced. Diversity at the plant breeding stage is essential for the practice of selection. Sexual reproduction takes place in flowers.

Before a male gamete can combine with an egg cell, pollination (transfer of pollen from the anther of the filament to the stigma of a pistil) must take place. There are two types of pollination:

(1) Self-pollination: the pollen of a flower lands on the stigma of the same flower. Self-pollinated plant species usually show little variation from generation to generation.

(2) Cross-pollination: the pollen of one flower is transferred to the stigma of another flower of the same species. This pollination is carried out with assistance from wind, water and animals. Cross-pollinated species are likely to show a lot of variation from generation to generation.

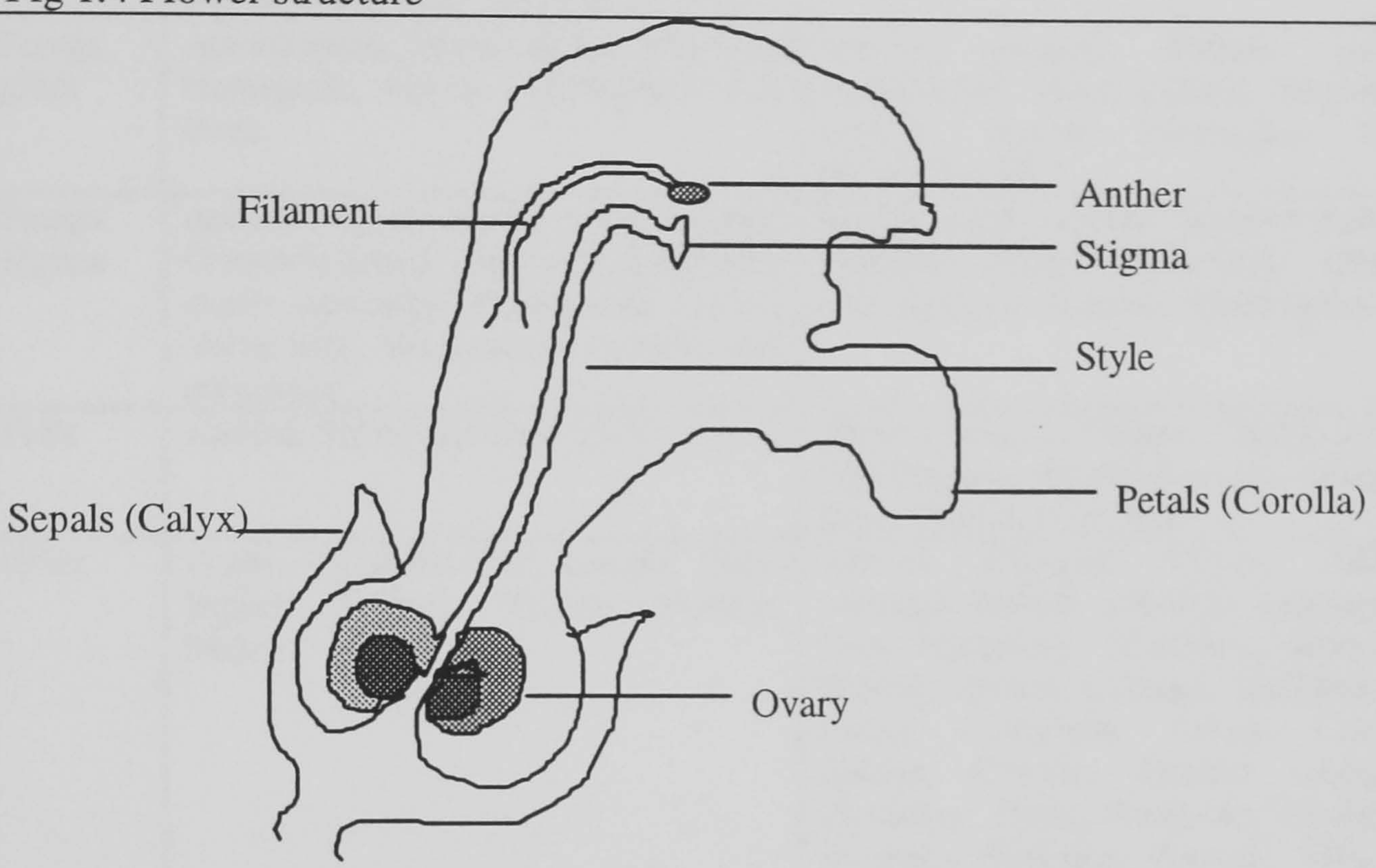
After pollination, a male gamete unites with an egg cell to form a fertilised egg or zygote.[10] A zygote carries genetic materials from both parents. After fertilisation, the zygote starts to divide into many cells, and thereafter becomes the seed containing the embryo or baby plant. Seed vary greatly in the length of time they

---

[10]The union of a male gamete with an egg cell is know as fertilisation.

remain viable for germination. The necessary requirements for germination are water, air, suitable temperature and for some species - light.

Fig 1.4 Flower structure



Sepals - green, leaf-like structures at the base of the flower. Their main function is to form a protective sheath around the bud.

Petals - colourful parts of the flower that attract insects and protect the vital parts of the flower.

Stamens - male reproductive organs. Each consists of: (a) **filament** - stalk which support; (b) **anther** - in which pollen grains are produced and held until they are ripe; (c) **pollen grains** - each containing two male gametes.

Pistil - the female reproductive organ, usually in the centre of the flower. It consists of: (a) **stigma** - top of pistil, on which pollen lands; (b) **style** - narrow structure down which the pollen grows for passageway of the male gamete; (c) **ovary** - base of pistil. It contains the egg cells.

Table 1.2 Reproductive systems in plants[11]

	Self-pollinated species	Cross-pollinated species
Cereal grass	Barley, Foxtail millet, Oat, Rice, Sorghum, Wheat	Maize, Rye
Legume	Broadbean, Chick pea, Common bean, Cowpea, Lima bean, Mung bean, Peanut, Pea, Soybean, Sweet pea, Urd bean	Scarlett runner bean
Forage grass	Annual fescue, Foxtail barley, Mountain bromegrass, Slender wheatgrass, Soft chess	Annual ryegrass, Buffalo grass, Orchardgrass, Meadow fescue, Perennial ryegrass, Smooth bromegrass, Tall fescue, Timothy
Forage legume	Annual sweet clover, Bur clover, Crotalaria juncea, Hop clover, Strawberry clover (common), Subterranean clover, Velvet bean, Vetch (common, hairy, and pannonica)	Alfalfa, Alsike clover, Birdfoot trefoil, Crimson clover, Strawberry clover (Palestine), Sweet clover, White clover
Fruit	Apricot, Nectarine, Peach, Citrus	Apple, Avocado, Banana, Cherry, Date, Fig, Graphes, American grapes, Mango, Olive, Papaya, Pear, Plum
Other	Cotton, Eggplant, Flax, Lettuce, Okra, Pepper, Tobacco, Tomato, Parsnip, Endive	Almond, Chestnut, Filbert, Pecan, Pistachio, Walnut, Artichoke, Asparagus, Beet, Blackberry, Blueberry, Broccoli, Brussels sprouts, Cabbage, Cauliflower, Carrot, Castorbean, Celery, Chard, Collard, Chicory, Chinese cabbage, Cucumber, Hemp, Raspberry, Rhubarb, Rutabaga, Safflower, Spinach, Squach, Strawberry, Sunflower, Sweet potato, Turnip, Watermelon

1.1.3.2. Asexual reproduction

One form of asexual reproduction which is found in plants is vegetative propagation which refers to the reproduction of new plants from parts of plants that are not in themselves sexually reproductive organs:

(1) Bulbs - miniature plants enclosed in large, food-storage leaves, which grow underground from a short, thick stem. Examples are tulip, lily, narcissus, hyacinth and onion.

---

[11]This table is based on information in Allard, R.W. *Principles of Plant Breeding*, John Wiley & Sons, New York, 1960, pp. 40-41.

(2) Rhizomes - horizontal stems, partly underground, from which whole new plants will grow at intervals. Examples are grasses, iris and Solomon's seal.

(3) Stolons - stems which grow parallel to but above the ground, and from which grow roots and an entire new plant where the plant makes contact with the soil. Examples are strawberries and blackberries.

(4) Tubers - enlarged underground stems containing stored food, with buds from each of which an entire new plant will grow. Examples are potato and Jerusalem artichoke.

(5) Root-stocks - parts of underground roots, from which an entire new plant will grow. Examples are ferns.[12]

1.2. Plant breeding

Plants have been used by mankind (and its ape ancestors) since the species first appeared on the Earth, for numerous purposes such as food, feed, medicine and textiles. When humans began to cultivate plants, they selected and saved plants with desirable characteristics, such as producing delicious fruits; and when they started to travel around the world, they brought plants from various parts. An inscription of about 2500 B.C., found in Mesopotamia, tells of Sargon crossing the Tsurus Mountains in Asia Minor and mentions incidentally that he brought back figs, vines and roses.[13] The most important event in the movement of plants was the discovery of America. Many plants indigenous to the Americans were introduced to Europe; for example, potatoes which until this time were unknown in Europe but have subsequently become part of the staple diet of Europeans.

---

[12]Hanauer, E.R. *Biology Made Simple*, W.H. Allen, London, 1980, pp. 231-232.

[13]Allard, R.W. *Principles of Plant Breeding*, John Wiley and Sons, London, 1960, p. 19.

Selection and cross-breeding, and chemical treatment, have been used traditionally to improve the basic stock, though these simple techniques are time-consuming processes and their applications are limited. Moreover, the desirable traits are transferred into a next generation merely by sexual reproduction somewhat in the way of a lottery of life. The two parent plants must have closely related genetic bases.[14] However, scientists have developed advanced techniques used to transfer some traits into plants by asexual means such as cell fusion.

1.2.1. Basic principles of plant breeding

Plant breeding may be broadly defined as the art and science of improving plant characteristics, with the aim of enhancing properties, such as productivity, disease resistance and stress tolerance.[15] It usually involves the cooperation of workers in

---

[14]Marx, J.L. *A Revolution in Biotechnology*, Cambridge University Press, Cambridge, 1989, p. 130.

[15]Lawrence suggests that although the objectives in plant breeding programmes are manifold, in general the main aims in plant breeding include the following.

(1) Yield improvement: A common aim of plant breeders is to increase yield. The development of plant breeding during the Green Revolution has underlined the importance of yield improvement.

(2) Climate: The climatic pattern in various parts of the world is the unpredictable variations. Plant varieties should be reasonably tolerant of climatic variations.

(3) Uniformity: Uniformity between individuals comprising a crop, in time of germination, rate of growth, time of flowering, fruiting and maturity, of yield, size, shape, quality, etc. is important to farmers. Uniformity makes cultivation more manageable in a number of aspects, for instance, the application of the pre-emergence herbicides, thinning-out market crops where this is necessary and harvesting by maximising the amount of flowers, seeds, fruits, vegetables ready at the same period, by reducing the amount of grading necessary as with agricultural products.

(4) Consumer satisfaction.

(Lawrence, W.J.C. *Plant Breeding*, Institute of Biology's Studies in Biology No. 12, Edward Arnold, London, 1968, pp. 13-16.)

other disciplines, including genetics, biochemistry and pathology.[16] The contribution made by plant breeding to agricultural development is incalculable.[17]

Plant breeding involves a number of steps:[18]

(1) Analysis and definition of problem(s): e.g. disease epidemics and low productivity.

(2) Establishment of programme goal(s): e.g. disease resistance, improved quality and productivity or new characteristics. A breeder defines the characteristics (phenotypes) of the cultivar[19] he wishes to develop. He will work towards an ideal type or "ideotype" which can be regarded as a biological blueprint.[20]

(3) Selection of germplasm(s):[21] Germplasm(s) should possess the traits needed to meet the programme goals. These germplasms may be used as either potential new

---

[16]Frey, K.J. (ed.) *Plant Breeding*, Symposium held at Iowa State University, Iowa State University Press, Ames, Iowa, 1967, p. 3.

Most accomplishments in plant breeding are the result of teamwork that include geneticists, physiologists, pathologists, entomologists, biochemists and plant breeders. (Information from website: http://www.agnr.umd.edu/users/agron/101/costa.htm)

[17]As evidenced by the Green Revolution in 1960s when scientists developed a number of new plant varieties, such as high-yielding varieties of wheat and rice. (See, for example, Griffui, K. *The Political Economy of Agrarian Change: An Essay on the Green Revolution,* MacMillan, London, 1974)

[18]Bliss, F.A. "Plant Breeding, Crop Cultivars, and the Nature of Genetic Variability" in *Intellectual Property Rights Associated with Plants,* ASA Special Publication No. 52, Crop Science Society of America, et al., Madison, USA, 1989, pp. 69-89.

[19]"Cultivar" is derived from culti=cultivated and var=variety.

[20]Smartt, J. "Biological Problems in Meeting DUS Standards for Plant Variety Rights Registration" [1985] 43 Plant Variety Protection 28, at 29.

[21]Germplams are cells from which a new plant can be regenerated, as in collections of plant seeds in seed banks. (Lawrence, E. (ed.) *Henderson's Dictionary of Biological Terms,* Longman, London, 1995, p. 226.)

cultivars or parents for crossing in order to produce genetically variable populations.

(4) Selection of breeding methods: The choice between methods depends on many factors, such as the mode of plant reproduction and the type of cultivar used commercially.

The traditional techniques, selection and hybridisation, have been used in plant breeding for several centuries. But since the fundamental discovery of the double-helix structure of DNA (Deoxyribonucleic acid) by Crick and Watson in 1953, and the invention of "gene-splicing" by Cohen and Boyer in the 1970s, what is nowadays called plant biotechnology has evolved from traditional techniques to the highly sophisticated means needed to produce genetically-engineered plants.

1.2.1.1. Hybridisation

Hybridisation has long been an important tool in plant breeding programmes; it is the crossing, or mating, of different plants (genetically dissimilar plants) with the intention of combining some of qualities of each parent.

In hybridising most species, pollination is normally by hand (using a fine brush to transfer pollen grains from one plant to the stigma of another plant). The genetic consequence of hybridisation in the first generation (F1) is heterozygosity;[22] and

---

[22]To understand the meaning of "heterozygosity", one should look at Mendel's Law of Inheritance. Mendel discovered that a gene existed in different forms called "alleles". For example, a pea can have either yellow or green seed. One allele of the gene for seed colour gives rise to yellow seed, the other to green. Moreover, one allele can be dominant over the other (recessive) allele. In this case, yellow is dominant. Mendel showed this when he crossed a green-seeded pea with a yellow-seeded pea. All the progeny in the first generation (F1) had yellow seed.

the essential characteristics of an F1 hybrid cannot be reproduced beyond the first generation from seed because the hybrid is not stable thereafter. Breeders of such hybrids may use the lack of stability as biological protection against misappropriation by other breeders since access to the parent plants are necessary to produce an F1 hybrid. Therefore, it is not feasible for farmers to save seed from hybrids for the following season.

1.2.2. Advanced methods

Despite the wide applications of conventional methods, breeders have encountered a major problem with regard to the genetic and reproductive characteristics of plants. In breeding programmes, only specific genes should be introduced into a new plant; but conventional methods transfer all genes from parent plants to offspring. Some parental genes may reduce the value of offspring.

However, when these F1 yellow seeded peas were allowed to self-fertilise, some green seeded peas reappeared. Mendel concluded that the green allele must have been preserved in the F1 generation, even though it did not affect the seed colour of these peas. His explanation was that each parent plant carried two copies of the gene; that is, the parents were diploid, at least for the characteristics he was studying. According to this concept, homozygotes have two copies of similar allele, either two yellow alleles (YY) or two green alleles (gg). Herterozygotes have one copy of each allele (Yg). The two parents in the first mating above were homozogotes (YY and gg); the resulting F1 peas were all heterozygotes (Yg). Mendel explained that sex cells (a male gamete and an egg cell) are haploid, i.e. containing only one copy of the gene. Homozygotes can produce sex cells that have only one allele whereas heterozygotes can produce sex cells having either allele. (Weaver, R.F. et al. *Genetics*, 2nd ed., Wm C Brown Publishers, Dubuque, USA, 1992, p. 5.)

Scientists believe that modern techniques based on biotechnology will ease this problem. Plant biotechnology has become a common tool in plant breeding, and scientists have developed a number of techniques which have been utilised in plant breeding programmes. What is plant biotechnology? What techniques are used in plant breeding?

1.2.2.1. Plant biotechnology

Biotechnology is an interdisciplinary subject, involving a wide range of subject areas; it has its grassroots in biological, chemical and engineering sciences, leading to a host of specialisms, including molecular genetics and biochemical engineering.[23] (See Fig 1.5) The United States Office of Technology Assessment (OTA) has defined biotechnology as the use of living organisms or their components in industrial process.[24]

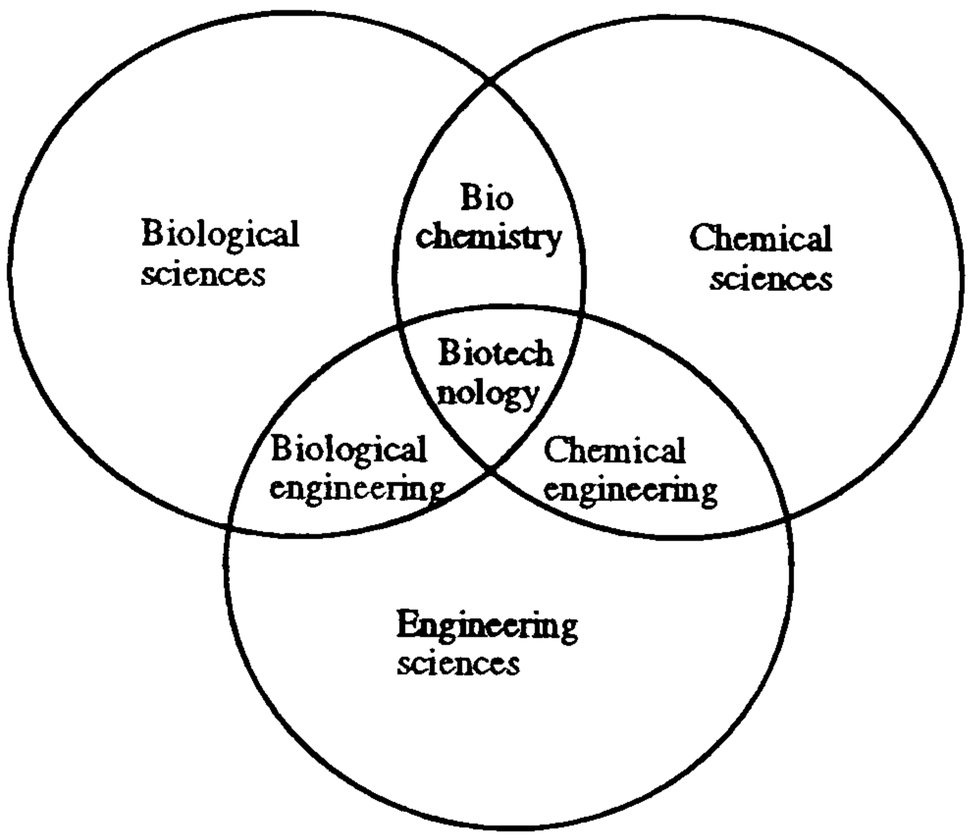
The development of biotechnology is largely dominated by molecular biology (a modern branch of biology concerned with explaining biological phenomena in molecular terms). Scientists have learnt how to manipulate cells and their components in order to produce useful products, including new and improved living organisms, vaccines, antibiotics and enzymes.

---

[23]Moo-Young, M. *Comprehensive in Industrial, Agriculture and Medicine, Vol. 1 (The Principles of Biotechnology: Scientific Fundamentals),* Pergamon Press, Oxford, 1985, p. XV.

[24]*Impacts of Applied Genetics: Micro-organisms, Plants and Animals,* United States Office of Technology Assessment, USA, 1981, p. 4.
Also see, for instance, Trevan, M.D. et al. *Biotechnology: The Biological Principles,* Open University Press, Milton Keynes, 1987, p. 3 which defines the term as the application of biological organisms, systems or processes to manufacturing and service industries.

Fig 1.5 Interdisciplinary structure of biotechnology[25]



1.2.2.2. Modern techniques in plant breeding

Techniques developed in the past twenty to thirty years, including genetic engineering and tissue culture, are used by plant breeders to circumvent the problem associated with traditional methods. The following paragraphs examine several of these techniques, though it should be noted at the outset that it may not always be practical or cost-effective to employ the techniques on a commercial scale.

1.2.2.2.1. Tissue culture

Tissue culture involves the propagation of tissue removed from living organisms in an appropriate growth medium. With this technique, a number of identical cells can be produced rapidly. The application of tissue culture in plant breeding is relatively

---

[25]This information is based on Moo-Young, M. *Comprehensive in Industry, Agriculture and Medicine, Vol. 1 (The Principles of Biotechnology: Scientific Fundamentals),* Pergamon Press, Oxford, 1985, p. XV.

widespread (compared to animal breeding) because plant cells have special characteristics called totipotency; a plant cell has a complete set of genes. The advantage of this property is that the cells can regenerate into plants and express the plants' complete range of metabolisms.[26] The first step of tissue culture is that plant tissues called explants are taken from plants and transferred onto a medium supplemented with plant growth chemicals. Cells then develop into a mass of undifferentiated cells called calluses which subsequently form whole plants. Alternatively, calluses can be maintained *in vitro*[27] by subculture techniques for subsequent mass cultivation. (See Fig 1.6)

The potential advantages of plant tissue culture over conventional breeding methods include:

(1) production of large number of plants or clones in a short period and using small confined facilities;

(2) propagation of materials in an environment free of viruses and other pathogens, and under optimum conditions;

(3) ability to propagate plant species which are difficult to propagate vegetatively once they flower, or to propagate species where *in vitro* culture techniques are commercially superior to other conventional methods of propagation;

(4) ability to supply plants on a year-round rather than on seasonal basis; and

(5) maintenance of heterozygosity and the cloning of superior individuals from both qualitative and quantitative viewpoints.[28]

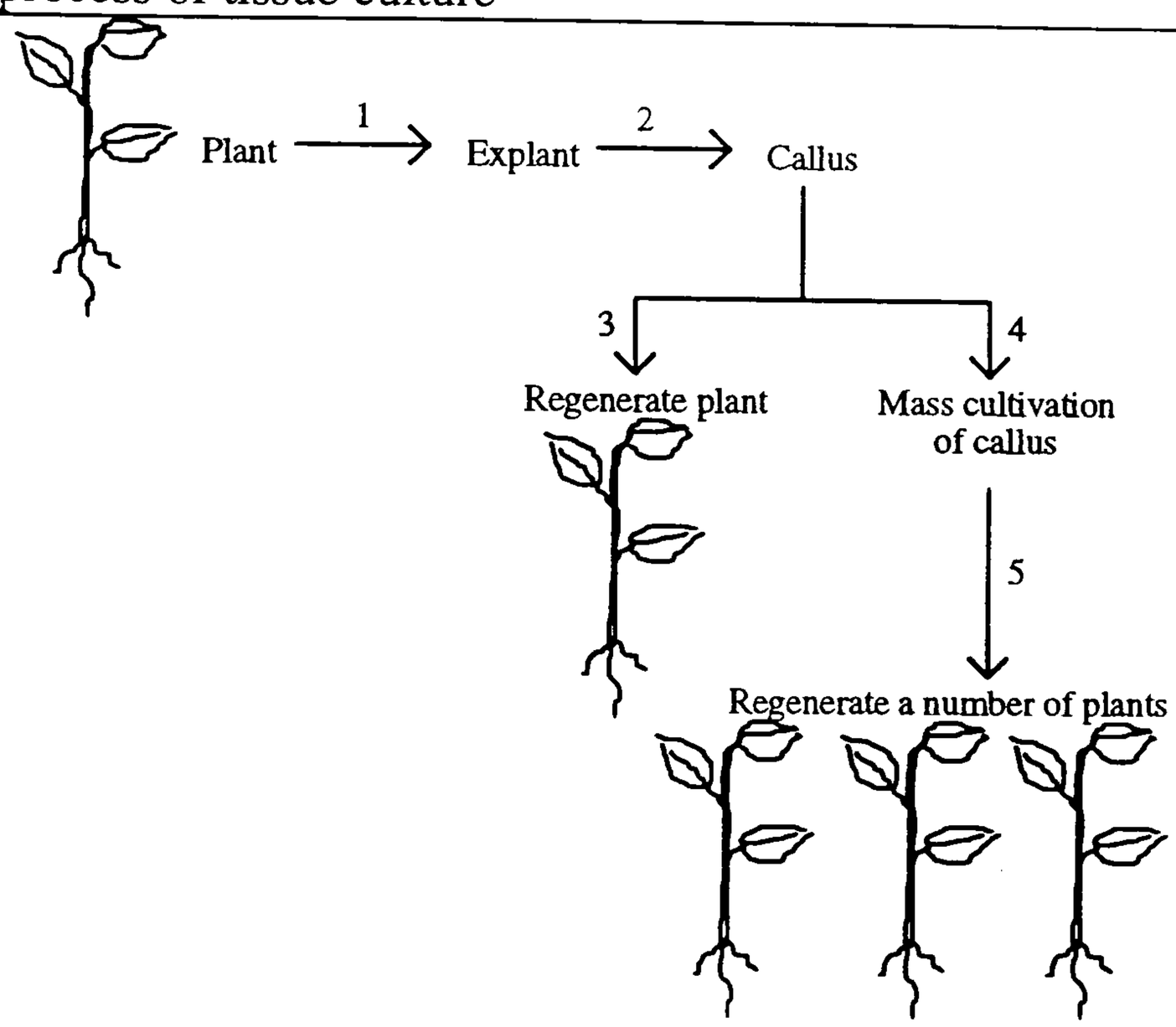
---

[26]Stafford, A. et al. *Plant Cell and Tissue Culture,* Open University Press, Milton Keynes, 1991, p. 244.

[27]*In vitro* involves a designating biological process made to occur experimentally in isolation from a whole organism; the term, literally, means "in glass", i.e. in a test tube. (King, R.C. *A Dictionary of Genetics,* 4th ed., Oxford University Press, Oxford, 1990, p. 167.)

[28]Johnston, A. et al. *New Technologies and Development,* United Nations, Paris, 1986, p. 111.

Fig 1.6 The process of tissue culture



1. Explants or plant tissues are removed from plants.

2. Explants are transferred onto a medium and subsequently cell propagation occurs to form calluses.

3. Calluses are removed from the explants and regenerate to a whole plant.

4. Alternatively, calluses are subcultured *in vitro* to form an increasing number of calluses.

5. Calluses regenerate to a number of whole plants.

Table 1.3 Timetable for new variety development by tissue culture (somaclonal variation) of elite cultivars[29]

Crop species	Conventional breeding (years)	Tissue culture (years)
Tomato plant	7 - 8	3 - 4
Sugar beet	14 - 15	7 - 8
Sugar cane	14	7
Coffee tree	15 - 20	7 -10

Although it may not be correct to say that tissue culture is a technique used to develop or improve plant varieties - because essentially tissue culture is a

---

[29]This information is based on Johnston, A. *New Technologies and Development,* United Nations, Paris, 1986, p. 112.

propagative technique - nonetheless the technique plays an important role in some plant breeding programmes.

1.2.2.2.2. Spontaneous and induced mutation

Mutation is an hereditary change in the genetic material, a change that can be passed on to the next generations. Mutation is a source of genetic variability in living organisms. Some occur without a known cause, i.e. spontaneous mutation. It may result from an inherent low level of physiological errors during DNA replication, or it may be caused by unknown agents in the environment.[30] Scientists have found that external agents (mutagens) can increase the mutation rate. Hermann Muller induced a mutation by X-rays in Drosophila.[31] An induced mutation is of interest because it results from known mutagens and therefore is controllable. Mutagens include X-rays, gamma rays, ultraviolet light and chemical agents. The induction of mutations has been important in plant breeding; for example, virus-resistant potatoes were developed by induced mutations and tissue culture.[32]

---

[30]Gardner, E.J. *Principles of Genetics,* 8th ed., John Wiley & Sons, New York, 1991, p. 289.

[31]Hartl, D.J. *Basic Genetics,* 2nd ed., Jones and Bartlett, Boston, 1991, p. 374.

[32]Also see, for instance, International Atomic Energy Agency, *Induced Mutations and Plant Improvement: Proceeding of a Study Group Meetings,* Buenos Aires, 16th-20th November 1970 organised by the Joint FAO/ IAEA Division of Atomic Energy in Food and Agriculture, Vienna, 1972; scientists exhibited the progress in their research projects concerning the application of mutation which included "induced seed-coat colour mutations in beans" and "mutation breeding of yield and kernel performance in spring barley".

1.2.2.2.3. Genetic engineering

Advances in the science of genetics, especially the knowledge that alterations at the genetic level will have an effect on the phenotypes of organisms, have led to the development of genetic engineering, a technique now used in plant breeding. The technique consists of two main processes: DNA recombination and gene cloning.

1.2.2.2.3.1. DNA recombination

DNA recombination involves the joining of DNA segments derived from biologically different sources.

(1) Cutting DNA molecules:

This step results from the reaction of restriction enzymes (endonuleases)[33] to cut DNA at several sites along a molecule. The most useful nature of a restriction enzyme is that the enzyme recognises the same unique base sequence regardless of the source of DNA;[34] therefore, specific DNA fragments can be selected from various sources.

(2) Joining DNA fragments:

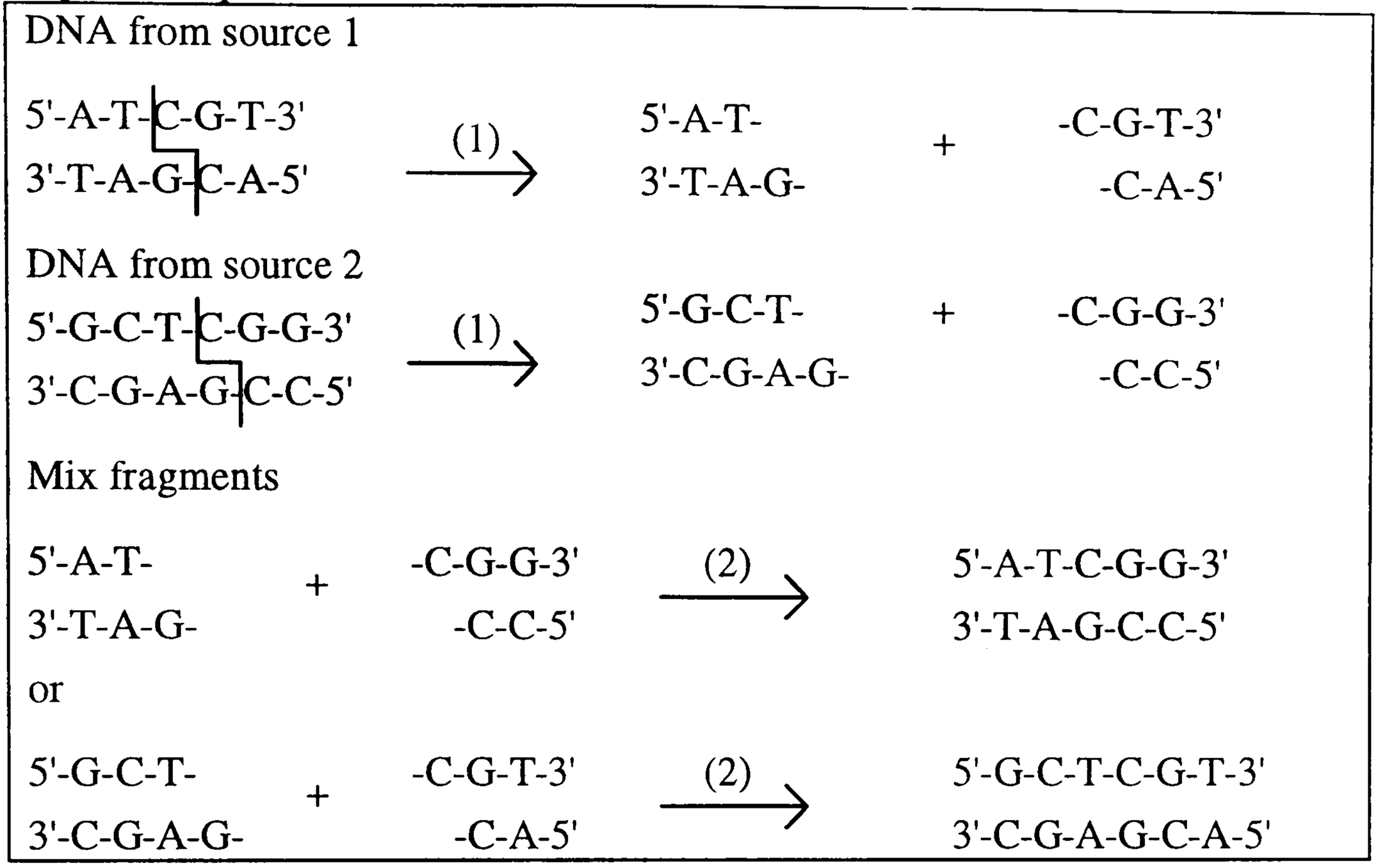
DNA fragments produced using a restriction enzyme can be joined in any sequences desired. A new DNA molecule is created with DNA fragments from different sources.

---

[33]A restriction endonuclease is an enzyme that cleaves foreign DNA molecules at specific recognition sites. (King, R.C. et al. *A Dictionary of Genetics,* 4th ed., Oxford University Press, Oxford, 1990, p. 274.)

[34]Burns, G.W. et al. *The Science of Genetics,* 6th ed., MacMillan, New York, 1989, p. 408.

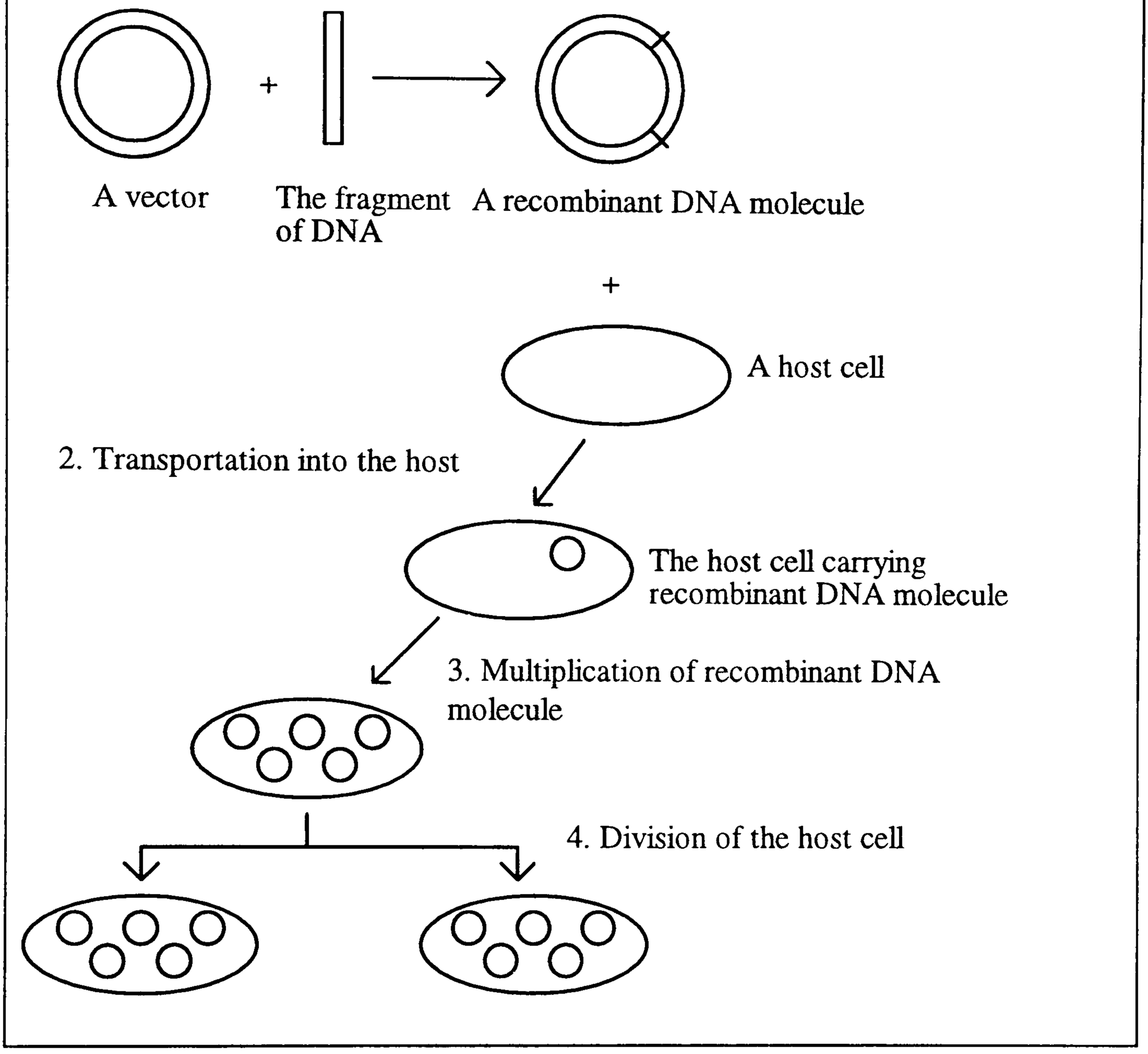
Fig 1.7 The process of DNA recombination



1.2.2.2.3.2. Gene cloning

A DNA fragment is inserted into a circular DNA molecule called a vector to produce a recombinant DNA molecule. A vector functions as a vehicle bringing a recombinant DNA molecule into a host cell. A vector is a self-replicating DNA molecule; therefore, it multiplies within a host cell and produces identical copies of not only itself but also of a foreign DNA fragment that it carries. When a host cell has a number of multiplied DNA molecules, the cell itself divides and the multiplied DNA molecules are passed to new cells. As such, a number of cells with identical genetic material are produced.

Fig 1.8 The process of gene cloning[35]



Genetic engineering is becoming an important tool in plant breeding. It enables the breeder to transfer genes from one plant species to another and from non-plant organisms to plants. In some cases, genes can be transferred from bacteria to

---

[35]This information is based on Brown, T.A. *Genetics: A Molecular Approach*, 2nd ed., Chapman & Hall, London, 1992, p. 376.

plants.[36] The desirable genes include genes for improving yield, hardiness and disease resistance.[37] Moreover, the property of totipotency in plant cells is an advantage for genetic engineering; it enables scientists to regenerate a whole plant from an individual genetically modified cell. Sandoz Agro has developed transgenic corn plants which are resistant to mixed infections of maize dwarf mosaic virus and maize chlorotic mottle virus.[38]

1.3. Distribution of new varieties[39]

After developing a new commercial variety, the breeder will have to introduce the variety into the market in order to recoup his investment and make a profit. New varieties can be commercialised in several forms, including bulbs, whole plants and seed. The commercialisation of plant varieties beyond the breeding stage includes certification and commercial seed production. Each procedure may be the responsibility of different groups. Breeders develop new varieties and carry out small-scale production of seed (breeder seed). Certification agencies (normally government bodies) are concerned with the steps by which seed from breeding programmes is turned over to the seed grower, and they also administer

---

[36]For instance, Ciba-Geigy has developed a genetically engineered maize by inserting genes from *Bacillus thuringiensis* which produce a toxin killing corn borer. ([1996] 151 New Scientist 8).

[37]Persley states that research and development is concentrating on the genetic engineering of plants for herbicide resistance, insect resistance, disease resistance, improved protein composition and improved postharvest handling. (Persley, G.J. *Beyond Mendel's Garden: Biotechnology in the Service of World Agriculture*, CAB International, Oxford, 1990, p. 25.)

[38][1993] 11 BIO/TECHNOLOGY 1559.

[39]This Section is mainly based on information in Chapter 36 of Allard, R.W. *Principles of Plant Breeding*, John Wiley & Sons, New York, 1960.

regulations of production and marketing.[40] Seed produced by seed growers on a large scale is called certified seed. Commercial seed production is normally in the hands of seedsmen and selected farmers who have the equipment and experience to grow, clean, and market large quantities of pure seed.

Table 1.4 Classes of Seed by the International Crop Improvement Association[41]

Breeder seed	Seed or vegetative propagating material is produced by or under the direct control of the sponsoring plant breeder. It is the basis of the first and recurring increases of foundation seed.
Foundation seed	Seed is designated by an agricultural experiment station. Production must be carefully supervised or approved by representatives of an agricultural experiment station. It is the source of all other certified-seed classes, either directly or through registered seed.
Registered seed	It is the progeny of foundation or registered seed. Its production and handling must be approved and certified by the certifying agency, and its quality must be such that it is suitable for the production of certified seed. Registered seed is used as the source of certified seed in some crops by some agencies. In other cases the registered-seed class is omitted.
Certified seed	Certified seed is the progeny of foundation, registered, or certified seed. It is the seed produced on a large scale by certified-seed growers for general farm sale. It must be produced and handled in such a way as to meet the standards set by the certifying agency.

1.4. Seed production

Humans have long used seed not only as food but also for propagating plants. Historical evidence has shown that before 8000 BC humans had likely become collectors of wild grain and a thousand or so years later they were actually cultivating grains.[42] Seed are an important commodity; their commercial value (in

---

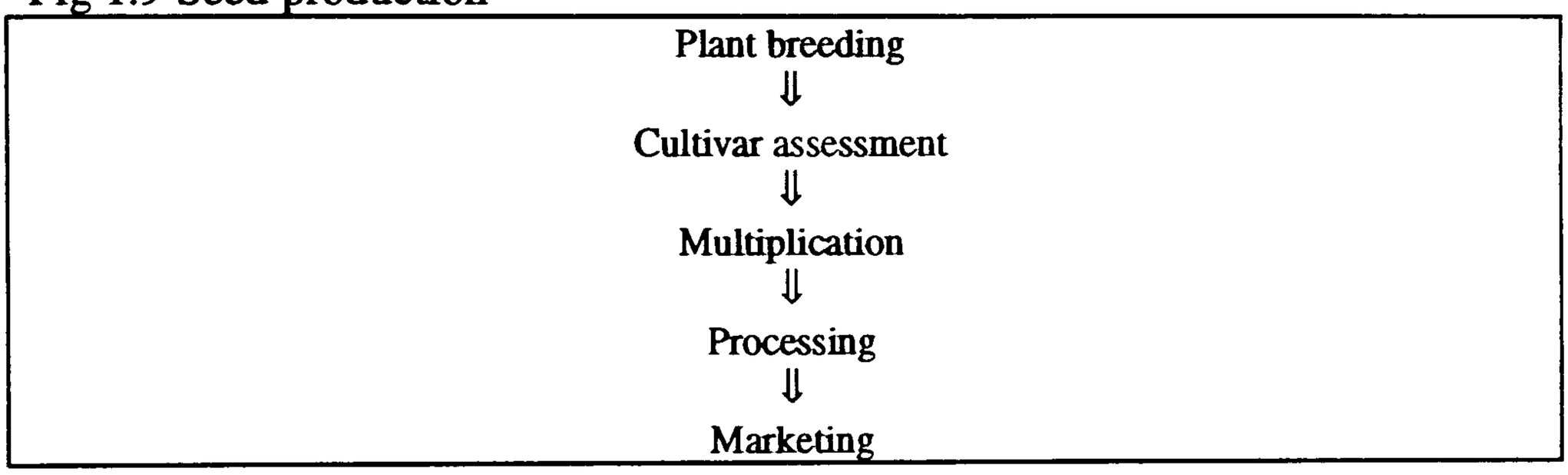
[40]See, for example, EC Directives which were established in 1966 under the terms of Article 100 of the Treaty of Rome; the Directives set out requirements for the certification and marketing of cereal seeds, fodder plant seeds, seed potatoes and, in 1969, for oil and fibre plant seeds. These Directives, as amended, are still in force and implemented by EC Member States by means of national legislation.

[41]Allard, R.W. *Principles of Plant Breeding*, John Wiley & Sons, New York, 1960, p. 458.

[42]Heiser, C.B. (Jr.), *Seed to Civilisation*, 2nd ed., W.H. Freeman, San Francisco, 1981, p. 6.

terms of export and import) is considerable. Seed industries have been growing rapidly since multinational agrochemical companies started investing in this business in 1960s.[43] At present, commercial seed production in most countries is dominated by multinationals. Seed production is illustrated by the following diagram.[44]

Fig 1.9 Seed production



(1) Cultivar assessment: Newly bred varieties have to be assessed in terms of significant characteristics, e.g. genetic stability, by growing them in different environments.

(2) Multiplication: Varieties are grown on farms in order to produce seed under a controlled system so as to prevent contamination, particularly by cross fertilisation; therefore, minimal isolation distances of crops are important. The large-scale production of seed is usually carried out by specialised seed growers on contract to a seed firm which provides the stock seed to raise the crop. Representatives of the seed firm generally inspect the crop during the growing season.

---

[43]For more details see Chapter 6 "The New Seedsmen" of Mooney, P.R. *Seeds of the Earth: A Private or Public Resource?*, Canadian Council for International Co-operation, Ottawa, Canada, 1979.

[44]For more details of seed production, see, for example, Thomson, J.R. *An Introduction to Seed Technology*, Thomson Litho, Scotland, 1979, and Gregg, B. *Seed: Conditioning, Storage and Marketing*, Department of Agricultural Extension, Thailand, 1983.

(3) Processing: This step involves harvesting, drying, cleaning, storage and packaging. When mature, crops are cut and stooked to ripen before threshing. Crops are threshed from the stooks using a combine harvester as a stationary thresher, carefully adjusting the drum speed and concave setting to suit the seed. Some plant species need individual treatment.[45] Normally the harvested seed are sent to be processed in a factory located near seed producing areas. As harvested, seed are usually not suitable for sale and planting. Many contaminants have to be removed. Inert materials and off-size seed decrease seed quality and contribute to storage problems.

The commercial production of seed is both complicated and costly, and this may deter small investors from engaging in this business.[46]

---

[45]For instance, tomato and cucurbit fruits are usually crushed and the pulp extracted by acid. Onion and leek heads are cut individually and dried on sheets or in bags in an airy shed before threshing; leek is different to thresh unless the heads are well dried. Seed heads of most ornamentals are picked individually as they ripen. (North, C. *Plant Breeding and Genetics in Horticulture*, MacMillan, London, 1979, p. 132.)

[46]Also see Chapter 6 for the discussion concerning the rarity of misappropriation of plant varieties in seed industries.

Conclusion

Plant breeding has played a vital role in the agricultural world. Conventional breeding involves techniques such as cross breeding and selection, which are simple, but time-consuming and costly. The pace of development is inevitably restricted.

On the other hand, plant breeding has recently been dominated by biotechnology. "Modern" plant breeding has been revolutionised by the advent of genetics and other biotechnological methods and its potential for expansion appears limitless.

We live in an increasingly technological world, where no aspect of human existence is immune from the impact of technology. Economic strength goes hand-in-hand with technological development, as exemplified by the economies of Japan, Korea and Taiwan.

At present the three dominant technologies are biotechnology, computer and electronic science, and materials science. Biotechnology is developing rapidly and will have a significant impact on agriculture; already food-products from genetically-modified plants have been marketed in many countries, particularly in the United Kingdom and the United States.

CHAPTER 2

PLANT VARIETY RIGHT PROTECTION

Introduction

The subject of plant variety right[1] (PVR) is a backwater to the mainstream of intellectual property law, possibly for these reasons: the complicated nature of the legislation[2] and the paucity of litigation.[3] This chapter aims to chart its course and to simplify the subject, in the main by summarising the history of this special form of protection for new plant varieties, and by giving the main features of PVR systems, their administration, and of the rights themselves. In places, the discussion will focus on two model laws: the 1978 and 1991 texts of the International Convention for the Protection of New Varieties of Plants (UPOV) because the Thai government is considering ratification of the Convention and adoption of one of the texts.

---

[1]Under the UPOV Convention and the UK system, the right is referred to as a plant breeder's right.

[2]Byrne states that beyond the relatively small circle of officials whose task it is to apply the Act or administer the Convention, the law is not well known. It is not an easy law to comprehend, essentially because both the criteria for the grant of plant variety protection and the exclusive rights comprised in a grant reflect the way in which plants are bred and reproduced or propagated on a commercial scale. (Byrne, N. *The Scope of Intellectual Property Protection for Plants and other Life Forms*, Report prepared for the Common Law Institute of Intellectual Property, Intellectual Property Publishing Limited, 1989, p. 3.)

[3]For example, since the introduction of the Plant Varieties and Seeds Act 1964 in the UK, there has been only one reported infringement case (*Germinal Holdings Ltd* v. *H.R. Fell & Sons Ltd* [1993] Fleet Street Reports 434) in this country. Lawyers may find that it not is worth to invest their time and attempt to study this subject.

2.1. Emergence of legal protection for plant varieties

Considered alongside other forms of intellectual property protection, legal protection for plant varieties[4] is relatively new. The development (both early and recent) of plant variety protection is primarily a European phenomenon. In 1833 an edict promulgated by the Papal States provided that anyone discovering a natural product or introducing a new agricultural species was to obtain for a limited period of time an exclusive property right therein.[5] This edict, however, had no significant developmental impact on PVR protection as we know it today. In 1883, the Paris

---

[4]In an intellectual property circle, the protection covers two main legal forms: patents and PVR. However, in some occasions, trade secrecy may be used to protect plant varieties. See, for instance, *Pioneer Hi-Bred International* v. *Holden Foundation Seeds Inc* 31 USPQ2d 1385 where the US Court of Appeal found the trade secret misappropriation of genetic makeup of seed corn.

[5]Festschrift "Bundessortenamt heute," Hanover 1982, p. 1; cited in Lange, P. "The Nature Of Plant Breeders' Rights (Plant Variety Protection Law) and their Demarcation from Patentable Inventions" in *Industrial Patents and Plant Breeders' Rights - Their Proper Fields and Possibilities for their Demarcation*, Records of a Symposium held on the occasion of the eighteenth ordinary session of the Council of the International Union for the Protection of New Varieties of Plants, Geneva, 17th October 1984.

The introductory recitals of the 1833 Edict said:

"Deserving men who have applied their intelligence and industry to the discovery of new products and to the invention, improvement or introduction of new types of culture or technical solutions, or of new methods for their use, deserve to have the rewards of their research and their discoveries guaranteed to them to the same extent as the rewards deriving from science, letters or the fine arts. We have already provided sufficiently, in Our Edict of September 23, 1826, for means of guaranteeing the ownership of scientific and literary works, and We have now to concern ourselves with guaranteeing also the ownership of those works that relate to the progress of agriculture and its techniques by a more reliable and more expeditious method than that practised hitherto with respect to the grant of specific exclusive privileges. " (Emphasis added)

(Extract from *The First Twenty-five Years of the International Convention for Protection of New Varieties of Plants,* UPOV Publication No. 879(E), Geneva, 1987, p. 60)

Convention for the Protection of Industrial Property recognised protection for plant-related inventions at the international level. The Final Protocol of 20th March 1888 defined "industrial property" in the broadest sense; it embraced not only the products of industry in the strict sense but also agricultural products (wines, grain, fruit, cattle, etc.) and mineral products which were put into trade (mineral waters, etc.). Despite this recognition, plant breeders were still trying seventy years later to get intellectual property protection, particularly patents, for varieties.[6] Eventually, their efforts were rewarded by the emergence in the 1960s of a special form of legal protection for plant varieties, viz plant variety right.[7] In 1961, the

---

[6]The struggles were summarised in "Industrial Property and Plant Breeders' Rights" [1985] 45 Plant Variety Protection 14, at 15:

"An objection that is repeatedly raised to the patentability of the result of plant breeding work is that fact that the creation of a new variety results from joint action by man and by nature.... However, the main obstacle was seen in the fact that a new variety was created by means of a non-reproducible process which did not enable a man skilled in the art "to carry out the invention without having himself to act as an inventor or to possess particular gifts" (Frey-Godet, 1923)... Finally, it was objected that the breeder of a variety was forced with the impossibility of providing a complete description that was valid for every plant."

Plant breeders in some countries exploited various forms of protection for their varieties. For instance, in 1921 a breeder from the Southeast of France, in order to secure an exclusive market for a variety of carnation that he had bred, removed all the buds from the stems of cut flowers marketed by him, thereby preventing competitors from taking cuttings from them. This practice was also widespread in Italy, notably in the province of Imperia. ("The History of Plant Variety Protection"; in *The First Twenty-five Years of the International Convention for the Protection of New Varieties of Plants*, UPOV, Geneva, 1987, p. 69.)

[7]The situation was summarised in "Industrial Property and Plant Breeders' Rights" [1985] 45 Plant Variety Protection 14, at 16.

"The uncertainty of protecting plant varieties by means of patents led a number of States, as of the 1920s, to give breeders different form of protection. This was based, to begin with, on the exclusive use of a denomination of a category of seed or seedlings (e.g. elite seeds) or of a denomination trademark - thereby doing violence to trademark law - or both (Czechoslovakia in 1921, France in 1922), and subsequently to a limited form of exclusive commercial exploitation

International Convention for the Protection of New Varieties of Plants (UPOV) was signed by plenipotentiaries of Belgium, France, the Republic of Germany, Italy and the Netherlands.[8] The 1961 UPOV Convention was later amended by the Additional Act of 1972, and consolidated in the 1978 Convention. During the past three decades, the system has been shaped by various factors, including the development of plant biotechnology. The advent of recombinant DNA technology and other techniques, such as genetic engineering and cell fusion, have had a considerable impact (though not always directly) on companies involved in plant breeding.[9] It soon became clear that if PVR systems modelled on the UPOV Convention were to continue to play a significant role, the Convention itself would have to be reformulated to provide a broader scope of protection than was

---

of the variety (Netherlands in 1942, Federal Republic of Germany in 1953). In some States, the special arrangements assumed a place in the legal order side by side with the patent law. Such is the case, in particular, in the Federal Republic of Germany where the patent system finally opened up to plant varieties... In Italy, patents have become the sole form of protection for new plant varieties after case law had removed all objections that had been raised in opposition. Finally, no form of protection was available to breeders in countries such as Denmark, Switzerland or the United Kingdom.

The summary of the situation made in the proceeding paragraph suffices to show that it was unsatisfactory, both for the breeders and for the industrial property specialists. In view of that state of affairs, the industrial property circles expressed an opinion at the International Association for the Protection of Industrial Property (AIPPI) Congress in Vienna in 1952 that it was necessary to protect new varieties by means of patents or by any other means."

[8]The Convention was drafted under a substantial influence of the Law of June 27, 1953 on the Protection of Varieties and the Seeds of Cultivated Plants (Seed Law) of the Republic of Germany. Hans Schade (President of the Senate, German Patent Office) contributed to the work that resulted in the Convention.

[9]The technological development leads to changes in plant breeding programmes in many respects. Modern techniques, e.g. genetic engineering and cell fusion, enhance the possibility of plant development which could not been carried out by conventional means, for example, transfer of bacterial genes to plants. See Chapter 1 for more details.

available under the 1961 and 1978 texts.[10] The 1991 Convention has been constructed to achieve that objective. Whether the new Convention will achieve its end remains to be seen.

PVR systems based on one or other of the UPOV texts have been implemented in many developed and developing countries.[11] The Thai government is considering ratification of the Convention; yet the decision is expected to be delayed because of government bureaucratic inefficiency and tardiness.[12]

The development of PVR, particularly in Europe, shows that the right was created by breeders with the main aim of protecting breeders' financial interests. Legislation has therefore been shaped so as to respond to the needs of breeders. There are two main considerations for Thailand: what are the principal economic

---

[10]Byrne summarises the situation: "It was not until the late-1970s that the likely impact of this "new biology" on the legal protection of new plant varieties began to be debated by plant breeders. The debate questioned whether, in the new age of biotechnology, the system of plant breeders' rights established by the 1961 Convention gave plant breeders adequate protection, and the means of earning a fair reward for the effort of plant breeding. It was seen as wanting in several important respects, in particular as regards the freedom of rivals to use a protected variety in order to breed new varieties to compete with the protected variety and as regards the practice of farmers saving seed from a harvest in order to grow the next commercial crops. In each case, the work of the breeder was being taken without fair compensation." (Byrne, N. *Commentary on the Substantive Law of the 1991 UPOV Convention for the Protection of Plant Varieties,* Centre for Commercial Law Studies, Queen Mary and Westfield College, University of London, London, 1991, pp. 7-8.)

[11]They include Argentina, Australia, Austria, Belgium, Canada, Chile, Colombia, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Paraguay, Poland, Portugal, Slovakia, South Africa, Spain, Sweden, Switzerland, Ukraine, United Kingdom, United States of America, and Uruguay.

[12]Whether ratification of the UPOV Convention is appropriate for Thailand will be discussed in Chapter 4.

interests of plant breeders and the seed industry in Thailand and would the protection be likely to benefit them?[13]

2.2. What is PVR?

2.2.1 PVR and the concept of intellectual property

Considered historically, PVR law is an offshoot of patent law.[14] PVR was created to fill a vacuum in legal protection for plant varieties within an intellectual property regime. The right is a form of intellectual property,[15] or at least industrial property.[16]

---

[13]These two questions are to be tackled in Chapters 5 and 6.

[14]Byrne suggests that PVR has a superficial resemblance to the exclusive right of a patent holder. (Byrne, N. *The Scope of Intellectual Property Protection for Plants and Other Life Forms,* Report prepared for the Common Law Institute of Intellectual Property, Intellectual Property Publishing, London, 1989, p. 1.)

[15]The Convention Establishing the World Intellectual Property Organisation (WIPO), concluded in Stockholm on 14th June 1967 (Article 2(viii)) provides that "intellectual property" shall include rights relating to: (1) literary, artistic and scientific works; (2) performances of performing artists, phonogrammes, and broadcasts; (3) inventions in all fields of human endeavour; (4) scientific discoveries; (5) industrial designs; (6) trademarks, service marks, and commercial names and designations; (7) protection against unfair competition; and all other rights resulting from intellectual activities in the industrial, scientific, literary or artistic fields. PVR may belong to at least two branches of intellectual property: inventions in all fields of human endeavour and scientific discoveries.

Also see, for instance, Hughes states that intellectual property is intangible property, sharing much of the origins and orientation of all property but it is a more neutral institution than other forms of property: its limited scope and duration tend to prevent the very accumulated of wealth. (Hughes, J. "The Philosophy of Intellectual Property" [1988-89] 77 Georgetown Law Journal 290, at 291). Phillips and Firth suggest that intellectual property means the legal rights which

In a general sense, intellectual property is about the protection of creative ideas and works - the "products" of the mind, resulting from the exercise of human intellectual effort.[17] A new plant variety is a product of a breeder's activity - plant breeding or plant development. Development of new varieties requires considerable intellectual, financial, managerial and physical commitment.[18]

The overall objectives of intellectual property protection are to protect and reward, and thus provide an incentive to innovation and creation[19] whilst ensuring that the resulting rights and obligations strike a fair balance between the creator, his

---

may be asserted in respect of the product of the human intellect. (Phillips, J. et al. *Introduction to Intellectual Property Law*, 3rd. ed, Butterworths, London, 1995, p. 4.)

[16]The expression "industrial property" is sometimes misunderstood as relating to movable or immovable property used for industrial production, such as factories, equipment for production, etc. However, industrial property is a kind of intellectual property and thus relates to creations of the human mind. Typically, such creations are inventions and industrial designs. Simply stated, inventions are new solutions to technical problems, and industrial designs are aesthetic creations determining the appearance of industrial products. In addition, industrial property includes trademarks, service marks, commercial names and designations, including indications of source and appellations of origin, and the protection against unfair competition.

[17]Creations of the mind, such as an idea for an invention, a piece of music or a trademark, cannot, like physical objects, be protected against other person's use of them by the more possession of the object. Once the intellectual creation is made available for the public, its creator can no longer exercise control over the use made of the creation. This basic fact, that is, the inability to protect something by the mere possession of an object, underlies the whole concept of intellectual property law (World Intellectual Property Organisation, *Introduction to Intellectual Property Theory and Practice*, Kluwer Law International, London, 1997, p. 3.)

[18]See Chapter 1 for details about plant breeding.

[19]The justification for the protection of intellectual property is reflected in Article 27(2) of the Universal Declaration of Human Rights which declared that "Everyone has the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author."

competitors, and the users.[20] In the case of PVR, the interested parties include plant breeders, seed producers and users (mainly farmers). Opinions from these parties should be heard and analysed when PVR protection becomes a subject of discussion.[21]

Intellectual property, or at least the subject matter that it protects, can be an extremely valuable commercial asset, in some cases the most valuable asset a

---

[20]Ladas suggests that the laws of intellectual property represent a compromise amongst different, and often competing, interests, demands and claims of:

(a) inventors of new products or processes, creators of new designs that ornament products, and merchants who have adopted trademarks, trade names, or other distinguishing elements which identify the origin of products and guarantee the product standards;

(b) inventors and manufacturers with similar inventions or designs and merchants with similar trademarks or distinctive devices, or those who wish to use the discoveries, creations or symbols of others as effective instruments for the promotion of their interests;

(c) the community that wishes to prevent undue or excessive monopolies or restraints between those competing in the market and to gain the advantage of untrammelled competition and low costs;

(d) the public who wish to avoid being deceived as to the worth or genuineness of what they buy and not to be the victims of fraud, confusion, and mistakes;

(e) the social and legal order of the country which would be fatally injured if it ceased to encourage the spirit of invention and creation and if it would permitted unlawful competition and free use of the creative work of others. (Ladas, S.P. *Patents, Trademarks, and Related Rights, National and International Protection,* Vol. I, Harvard University Press, Cambridge, Massachusetts, USA, 1975, p. 11.)

[21]See, for instance, representatives from various organisations participated in the 1991 Diplomatic Conference for the Revision of the International Convention for the Protection of New Varieties of Plants in Geneva (hereinafter referred to as the 1991 UPOV Diplomatic Conference). They include International Association of Horticultural Producers, European Federation of Agricultural and Rural Contractors, International Community of Breeders of Asexually Reproduced Ornamental and Fruit-Tree Varieties, General Committee for Agricultural Cooperation in the European Economic Community, International Federation of the Seed Trade.

modern business may own, as witness for instance the registered trade mark "Coca Cola".[22] Intellectual property exists in every business, often without those involved in the business being aware that it owns intellectual property. As the importance of intellectual property for business success becomes ever more apparent at all levels in industry, competition, fair and unfair, becomes more intense. The commercial importance of intellectual property varies from business to business.[23] The economic importance of PVR to plant breeders and seed companies remains debatable.[24]

---

[22]Smith states that intellectual property is fast becoming the most valuable asset possessed by corporations. Various forms of intellectual property are the foundation of market dominance and continuing profitably for many companies. Very often they are the prized target in mergers and acquisitions. Intellectual property is coming of age. It is being recognised as an asset possessing the means by which economic benefits can be derived. Companies are licensing, selling, joint venturing, and trading intellectual property around the world. The global economy is based, in many ways, upon this commerce in intellectual property. (Smith, G.V. et al. *Valuation of Intellectual Property and Intangible Assets,* John Wiley & Sons, New York, 1989, p. vii.)

[23]See, for instance, Silberston, A. *The Economic Importance of Patents,* The Common Law Institute of Intellectual Property, London, 1987. The report concludes that the industries studied are divided into three categories: those industries for whom patents are essential, those for whom patents are very important, and the remaining category of those for whom patents are of lesser, but still considerable, importance. The first category consists of one industry only, i.e. pharmaceuticals. The second category consists of three industries, i.e. electrical instruments, active components and other chemical products. The final category includes telegraph and telephone, radio and electronic capital goods, instrument engineering, electronic data processing, aerospace, office machinery, other machinery, components and electronic consumer goods.

[24]The commercial importance of PVR in some countries and Thailand is to be discussed in Chapter 6.

2.2.2. The nature of PVR

PVR is an exclusive right granted by the State for a certain period[25] to an applicant whose plant variety satisfies statutory requirements, namely novelty, distinctness, uniformity and stability. By virtue of the exclusive nature of PVR, the proprietor can (1) prevent others from committing certain acts with regard to a protected variety, (2) seek remedies and compensation when he has not been able to exercise his exclusive right and an infringement has been officially established, and (3) license others to exploit his variety. The right can be exercised only within the territory of the state granting protection. In economic terms, an intellectual property right is normally associated with monopoly.[26,27]

Even though exclusivity is fundamental to the nature of intellectual property, PVR has often been misunderstood as a positive right, i.e. right to use or exploit protected varieties whereas PVR is the right to prevent others from committing

---

[25]PVR gives temporary protection to plant varieties. The duration of protection to a certain extent reflects the strength of protection. In theory, the said period should be long enough for a breeder at least to recoup an investment in developing his new variety. The appropriate period of protection should be determined by a number of factors, including the length of the commercial life of varieties and the time needed for the breeding process (e.g. tree breeding is relatively long, compared to shrub breeding for the longer biological life cycle of trees). Therefore, the 1978 and 1991 UPOV Conventions provide different periods of protection for two groups of varieties. See Article 8 of the 1978 UPOV text and Article 19 of the 1991 UPOV text in Appendix 2/1.

[26]"Monopoly" is generally understood as complete control of a particular subject or activity by one person or group of people, so that others find it difficult or impossible to compete with them. Economists posit that the market form of monopoly is at the opposite extreme from that of perfect competition. (See, for instance, Lipsey, R.G. *An Introduction to Positive Economics*, 5th ed., Weidenfeld and Nicolson, London, 1979, p. 261.)

[27]Whether this view is correct is open to question and in particular, that of PVR protection will be discussed in Chapter 6.

certain acts (e.g. reproducing the protected variety). PVR is not a pre-condition for marketing a new variety. In most countries, the commercialisation of plant materials is statutorily controlled[28] and these controls can be mistaken as consequential to the grant of PVR and fuel antagonism towards PVR in certain quarters.[29]

2.3. Scope of PVR

PVR enables the right proprietor to prevent others without authorisation from committing certain acts (referred to as infringing acts) with regard to the protected variety or to license others to exploit it. The scope of PVR is the crux of protection, determining its strength and adequacy. The boundary of protection is defined mainly by the array of protected subject matter and infringing acts.

---

[28]Once PVR is issued and an owner wishes to commercialise his protected variety (or its materials), he has to take account of certain regulations (where they exist):
(1) regulation for seed trade, e.g. the mandatory registration in national lists of varieties and the certification of seed.
(2) plant health regulations; and
(3) competition laws.
For example, the Seed Certification, under the UK Plant Varieties and Seeds Act 1964 and its subordinate legislation, regulates the marketing, or the importation or exportation, of seed or any related activities (whether by reference to officially published lists of permitted varieties or otherwise). The UK National Listing system under the Seeds (National Lists of Varieties) Regulations 1982 which prescribe specific species for which entry on the National List is a prerequisite of variety commercialisation. (See Appendix 2/2 for relationship between PVR, National Listing and Seed Certification.

[29]See Chapter 7 for the discussion about the allegation of some critics that PVR causes environmental harms.

The 1978 UPOV text provides that PVR subject matter covers the propagating material of a protected variety. This includes ornamental plants or parts thereof normally marketed for purposes other than propagation when they are commercially exploited as propagating material in the production of ornamental plants or cut flowers.[30] These propagating materials are important commercial forms of plant varieties. With the increasing application of modern biotechnological techniques in the development of new life forms, plant breeders agreed that the 1978 UPOV system did not provide adequate protection, and called for changes to the Convention. The 1991 UPOV text, in response to this pressure, strengthens protection by widening the array of subject matter. The protection covers not only the propagating material of the protected variety, but also (unlike the 1978 Convention) the harvested material (including entire plants and parts of plants)[31], the products made directly from harvested material of the protected variety, and essentially derived varieties.[32]

---

[30]See Article 5(1) of the 1978 UPOV text in Appendix 2/1.

[31]The protection of harvested material is an endeavour to strengthen the position of a PVR holder. He can exercise his right over harvested material which in the 1978 text was not protected. However, the 1991 text introduces a principle of cascade which can be understood in terms that the right can be exercised unless it has been possible for a PVR holder to exercise his right in respect of the propagating material. Furthermore, the authorised use of propagating material exhausts the right over harvested material. The principle of "cascade" also applies to acts in respect of products made directly from harvested material.

[32]See the definition of "essentially derived varieties" in Article 14(5)(b) of the 1991 UPOV text in Appendix 2/1 and its explanation in Appendix 2/3; "other varieties" are protected also, see Article 14(5)(a) of the 1991 UPOV text in Appendix 2/1.

Byrne holds the opinion that the extension of PVR to the "essentially derived variety" strikes at a form of plagiarism known, pejoratively, as "cosmetic breeding". A rival breeder repackages in a distinctive garb the "pith and marrow" or essential features of the protected variety, and thus avoids the payment of a royalty to the breeder of the protected variety. (Byrne, N. *Commentary on the Substantive Law of the 1991 UPOV Convention for the Protection of Plant Varieties*, Centre

Infringing acts are mainly commercial activities where misappropriation of protected property causes, or is likely to cause, economic loss to the owner. The forbidden acts in the 1978 UPOV text cover production for purposes of commercial marketing, offering for sale, marketing of protected varieties.[33] The 1991 text broadens infringing acts to cover production or reproduction (multiplication), conditioning for the purpose of propagation,[34] offering for sale, selling or other marketing, exporting, importing[35] and stocking for any of the aforementioned purposes.[36] As this list is non-exhaustive,[37] a member State can introduce additional infringing acts in its domestic PVR legislation. Nevertheless, it is difficult to imagine other commercially practical means of exploiting plant varieties which do not fall within the scope of infringing acts under the 1991 text.

In striking the balance between public and private interests, PVR law has safeguards against undue monopolisation, including statutory exemptions, compulsory licensing and exhaustion of rights.

---

for Commercial Law Studies, Queen Mary and Westfield College, University of London, 1991, p. 55.)

[33]See Article 5(1) of the 1978 UPOV text in Appendix 2/1.

[34]Conditioning covers cleaning, drying and packing which are important processes of commercial seed production.

[35]An import takes place once a product arrives in a country, regardless of whether it is released from customs. The custom-free area is part of the territory of a country.

[36]See Article 14 of the 1991 UPOV text in Appendix 2/1.

[37]It was heavily discussed in the 1991 UPOV Diplomatic Conference whether the list should be exhaustive. The concern was that the closed list would encourage third parties to find alternative ways of exploiting protected varieties without recourse to acts covered by PVR. The UPOV Secretary-General concluded that in his opinion the spirit of many industrial property conventions was indeed described in the fashion that they provided for minimum rights.

The two main statutory PVR exemptions are the farmer's exemption and the breeder's exemption. The 1978 UPOV Convention recognises the importance of free use of germplasm to developments in plant breeding by introducing a breeder's exemption. It allows the unauthorised use of a protected variety as an initial source of variation for the purpose of creating other varieties or for the marketing of such varieties.[38] However, authorisation is required if the repeated use of a protected variety is necessary for the commercial production of another variety. Thus, whilst the 1991 text puts the breeding of other varieties beyond the scope of the protection given by PVR, it limits the exemption for infringement. The authorisation of the proprietor of a protected variety is necessary for the commercialisation of varieties which are essentially derived or indistinguishable from the protected variety or require for their production the repeated use of the protected variety.[39]

The farmer's exemption (sometimes referred to as the on-farm crop exemption or farmer's privilege) is contentious because it allows farmers to keep propagating materials for sowing in a following season.[40] The exemption has led to concerns

---

[38]See Article 5(3) of the 1978 UPOV text in Appendix 2/1.

[39]See Article 15(1)(iii) of the 1991 UPOV text in Appendix 2/1.

[40]The Delegation of the Food and Agriculture Organisation of the United Nations submitted in the 1991 Diplomatic Conference that in some countries over 50 per cent of the food supply depended on the use of farm-saved seed. The estimates of the use of saved seed of small grain crops in 1990 were 89% in Australia, 85% in Spain, 70% in Canada and the US, 45% in France, 30% in the UK, 25% in Ireland. (Byrne, N. *Commentary on the Substantive Law of the 1991 UPOV Convention for the Protection of Plant Varieties*, Centre for Commercial Law Studies, Queen Mary and Westfield College, University of London, 1991, p. 61.) This practice is common in Thailand, particularly amongst rice farmers.

that farmers may misuse it.[41] The 1991 UPOV Convention, therefore, defines the farmer's exemption carefully, by allowing a farmer to use, for propagating purposes only on his holding, the product of the harvest which he has obtained by planting, on his holding, the protected variety or essentially derived variety.[42] This exemption does not cover the so-called "brown bag sale".[43]

---

[41]A British survey reveals that one breeding organisation describes this exemption as a continuing nuisance which has eroded seed business increasingly in recent years. Farmers do not only use their own saved seed but also blatantly sell it to neighbours at prices with which the trade cannot compete. (A survey of the views of the British plant breeding industry, commissioned by the Common Law Institute of Intellectual Property Law in 1988; cited in Llewelyn, M. *The Legal Protection of New Varieties*, PhD thesis submitted to University College of Wales, Aberystwyth, Dyfed, 29th September 1990, p. 331.)
In the 1991 UPOV Diplomatic Conference, the Dutch Delegation remarked that the exemption was not consistent with the goal of the revision of the UPOV Convention which aimed to strengthen the position of the breeder. It restricted PVR in order to permit farmers to use the protected variety for propagating purposes whereas the farmers were the main buyers and users of propagating material. It therefore created a major loophole in the protection offered under the Convention to the breeder.

[42]See Article 15(2) of the 1991 UPOV text in Appendix 2/1.

[43]It has been long established practice, particular in the US, for a small farmer to save and sell seed to other farmers. This practice was allowed under the US 1970 Plant Variety Protection Act in order to protect historical and traditional rights of a small farmer. The exemption has been construed restrictively in order to maintain a fair balance between private and public interests. However, it has been reported that the exemption was abused. See *Asgrow Seed Co* v. *Winterboer* 33 USPQ2d 1430 where respondent farmers -Denny and Becky Winterboer - planted 265 acres of Asgrow's seed and sold the entire crop (enough to plant 10,000 acres) to other farmers for use as seed. The US Supreme Court ruled out that respondents were not eligible for the exemption. Only seed that has been saved by a farmer to replant his own acreage can be sold.
The amendment of the Act in 1994 eliminates the exemption from infringement liability for farmers who sell saved seed to other farmers for reproductive purposes.

A concern that food production should not be restricted unreasonably by PVR justifies the provision for granting compulsory licences, found in most PVR systems. A compulsory licence is meant to discourage a PVR proprietor from acting as a sole monopolistic producer. The proprietor is encouraged to license voluntarily for an equitable remuneration which is not less than a reasonable royalty. Under the 1978 and 1991 UPOV texts a compulsory licence can be issued only for reasons of public interest.[44,45]

Legitimate commercialisation of any material of the protected variety, or of essentially derived and certain varieties, exhausts PVR, subject to certain limitations.[46] First, the material sold by the breeder or his licensee must be used consistently with its intended purpose. Second, PVR is not exhausted by acts which involve further propagation of the variety or export of propagating material of the variety to a country where PVR protection for the variety does not subsist, except where the exported material is for final consumption purposes.

---

[44]See Article 9 of the 1978 UPOV text and Article 17 of the 1991 UPOV text in Appendix 2/1.

[45]The US Delegation, in the 1991 UPOV Diplomatic Conference, has suggested that:

(1) A compulsory licence should be considered on its individual merit.

(2) It should only be permitted if the breeder was unwilling or unable to supply the public need for material of the variety at a price which may reasonably be deemed fair.

(3) The scope and duration of a compulsory licence should be limited to the purpose for which it was authorised.

(4) It should be non-exclusive and non-assignable.

(5) It should be authorised only for the supply of the domestic market of the Contracting Party that was restricting PVR.

(6) It should be terminated when the circumstances which led to it ceased to exist and were unlikely to recur.

(7) A compulsory licence and the amount of remuneration should be subject to judicial review.

[46]See Article 16 of the 1991 UPOV text in Appendix 2/1.

2.4. Main features of a PVR system

A UPOV member State must ensure that its national PVR legislation conforms with obligations laid down by the Conventions. Certain obligations require either administrative or technical examination. This is one of several important considerations for Thailand before determining the most appropriate PVR system.

2.4.1. Statutory subject matter

The 1978 UPOV text states that the term "variety" applies to any cultivar, clone, line, stock or hybrid which is capable of cultivation and which is homogenous and stable.[47] This definition appears to be synonymous with the concept of a protectable variety. Whether the definition of plant variety was necessary for PVR law was considered at the 1991 UPOV Diplomatic Conference.[48] After a long discussion, a definition of plant variety was incorporated in the 1991 UPOV text.[49] Unfortunately, the definition is comprehensible only to those with a scientific

---

[47]See Article 2(2) of the 1978 UPOV text in Appendix 2/1.

[48]The definition of ambiguous terms is necessary for the clarity of laws. Gardiner implicitly states that law is a semantic discipline, embroiled in uncertainty of interpretation. (Gardiner, R. "Language and the Law of Patents" [1994] 47 Current Legal Problems 255.) However, some participants in the 1991 UPOV Diplomatic Conference expressed views against the introduction of definition of "variety" in the new UPOV Convention. For instance, Mr. Von Pechhann from International Association for the Protection of Industrial Property (AIPPI) observed that, in the practical application of the plant variety protection systems, it had been the experience since 1961 and 1968 of AIPPI, as of most of the other Observer Organisations, that the lack of a definition of variety in the UPOV Convention and in the domestic laws had in no ways led to problems. Similar views were also put forward by representatives from International Community of Breeders of Asexually Reproduced Ornamental and Fruit-Tree Varieties and the United Kingdom.

[49]See Article 1(vi) of the 1991 UPOV text in Appendix 2/1.

knowledge of plant breeding; and even to them it may seem almost tautological. In simplified terms, a cultivated plant variety is a group of plants which is clearly distinguishable from other known varieties and which, when reproduced repeatedly by appropriate methods, retains its identity.[50] It is debatable however whether a particular variety can be represented by several plants, a single plant or by one or several parts of a plant.[51] What may amount to a variety, therefore, appears to be left to national legislation to decide.

One important difference between the 1978 and 1991 UPOV texts with regard to statutory subject matter is that the new text obliges a member State to provide PVR protection for all plant genera and species. This is a cause for concern in those member States without the adequate infrastructures for either administrative or technical examinations.[52] In the past, most member States of the 1978 UPOV Convention listed as eligible for the grant of PVR their economically important crop species.[53]

---

[50]Byrne, N. *Commentary on the Substantive Law of the 1991 UPOV Convention for the Protection of Plant Varieties,* Centre for Commercial Law Studies, Queen Mary and Westfield College, University of London, London, 1991, p. 21.

[51]It was put to, but not expressly adopted by, the 1991 UPOV Diplomatic Conference that a particular variety could be represented by several plants, a single plant or by one or several parts of a plant, provided that such part or parts can be used for the production of entire plants of the variety.

[52]See Section 2.5 "PVR examination" for more details.

[53]For example, in 1993 there were 23 categories of plant species which could be protected under the Canadian PVR system: African Violet, alfalfa, apple, barley, bean, canola, cherry. chrysanthemum, corn, dianthus, flax, grapevines, oats, pear, pea, poinsettia, potato, potentilla, rose, soybean, strawberry, wheat and yew. (D'Iorio, H. et al. "Plant Breeders' Rights - Practical Considerations" [1995] 11 Canadian Intellectual Property Review 277.)

2.4.2. Statutory requirements

PVR is granted for a new variety which meets the so-called DUS criteria, namely, distinctness, uniformity and stability. These requirements ensure the uniqueness of a new plant variety to which the right can be attached.[54]

Novelty is a prerequisite for the grant of PVR but it is not the same concept of novelty in the absolute sense that prevails in modern patent law. PVR novelty is commercial novelty. It can be damaged only if a variety is commercialised with the breeder's consent.[55] Prior knowledge *per se* of the variety is not therefore prejudicial to novelty.

A variety eligible for protection must be clearly distinguishable,[56] qualitatively or quantitatively, from any existing variety.[57] Distinctness is not determined by the

---

[54]Lord Wilberforce in *National Provincial Bank* v. *Ainsworth* [1965] Appeal Cases 1175 (House of Lords), at 1247 justified "property" as follows: "Before a right can be classified as property, it must be definable, identifiable by third parties, have some degree of permanence or stability, and be capable in its nature of assumption by third parties."

[55]Under Article 6 of the 1991 UPOV text, it covers the commercialisation of propagating and harvested material of a variety.

The 1978 and 1991 Conventions allow the so-called grace period, i.e. a variety can be legitimately commercialised no longer than the prescribed period before a PVR application is filed. (See Article 6(1)(b) of the 1978 UPOV text and Article 6(1) of the 1991 UPOV text in Appendix 2/1).

[56]Byrne suggests the term "clearly distinguishable" infer that distinguishing characteristics should be capable of precise description. (Byrne, N. *Commentary on the Substantive Law of the 1991 UPOV Convention for the Protection of Plant Varieties*, Centre for Commercial Law Studies, Queen Mary and Westfield College, University of London, London, 1991, p. 35.)

[57]See Article 6(1)(a) of the 1978 UPOV text and Article 7 of the 1991 UPOV text in Appendix 2/1.

commercial value of the characteristic conferred on the variety. Distinguishing characteristics are those which the breeder advances in support of his application.[58]

A variety has to be sufficiently uniform in the relevant characteristics which are used to describe and distinguish it.[59,60] Environmentalists contend that this

---

Any existing variety is that whose existence is a matter of common knowledge at the filing date, whether or not it is a protected variety. Filing for a PVR or entry in an official register (e.g. National List) in any country is deemed to render the variety a matter of common knowledge from the filing date, provided the application is successful. An existing variety would include a variety that is identical to or indistinguishable from the applied for variety. Making available (by sale or other means) varietal material of an identical or indistinguishable variety would not necessarily render the variety a matter of common knowledge.

[58]"Qualitative characteristics" are those which show discrete discontinuous states with no arbitrary limit on the number of states. Some characteristics which do not fit this definition may be handled as qualitative when the states encountered are sufficiently different from one another. Such characteristics include colour, shape and attitude.

"Quantitative characteristics" are those which are measurable on a one dimensional scale and show continuous variation from one extreme to the other. They are divided into a number of states for the purpose of description. Such characteristics include hairiness, undulation, curvation and adherence. (International Union for the Protection of New Varieties of Plants, *Revised General Introduction to the Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability of New Varieties of Plants,* revised by the Technical Committee on 14th November 1979, document C/XIV/9, reproduced from TG/1/2.) (Hereinafter referred to as the UPOV Guidelines)

UPOV publishes lists of distinguishing characteristics for each species. They are morphological, physiological, cytological, chemical, biochemical, agronomic and other characteristics.

[59]See Article 6(1)(c) of the 1978 UPOV text and Article 8 of the 1991 UPOV text in Appendix 2/1.

In practice, the UPOV Guidelines provide a maximum number of the accepted variants. The said number depends on different varieties, sample sizes and modes of reproduction (e.g. vegetative propagation, self-fertilisation and cross-fertilisation). If the number of variants in a repeated propagation is less than the accepted number, the variety is capable of being uniform.

requirement for uniformity decreases biodiversity by encouraging breeders to develop uniform varieties, but that is open to serious question.[61] Users or farmers want a high degree of uniformity for economic reasons. PVR law does not require uniformity of all characteristics of a protected variety.

A variety is stable in its relevant characteristics if it remains unchanged in these characteristics after repeated propagation or, in the case of such as hybrid varieties, at the end of a particular cycle of propagation.[62] In practice, this requirement may be seen as unnecessary since the UPOV Guidelines provides that a variety is stable if it has been shown to be uniform.[63]

---

[60]The principle laid down by the UK Controller of Plant Variety Rights in *Re Zephyr - Spring Barley* [1967] Fleet Street Reports 576 assists readers to better understand the requirement for uniformity. The uniformity criterion which imports an element of flexibility absent from the distinctiveness and stability requirements. It has been considered that "sufficient uniformity" for the purpose of a grant of PVR means the degree of uniformity a capable breeder skilled in the art can reasonably be expected to achieve having regard generally to the nature of plant material and more particularly to the biological possibilities of the species in which he is working including its mode of reproduction, and to any special features of the variety under consideration; therefore, the best test for this is to determine what breeders skilled in the art have achieved and are achieving in the particular species, and to make allowance for any special difficulties arising in the case of particular varieties.

[61]This issue will be tackled in Chapter 7.

[62]See Article 6(1)(d) of the 1978 UPOV text and Article 9 of the 1991 text in Appendix 2/1.

[63]However during the testing for distinctness and uniformity, careful attention has to be paid to stability. As far as necessary, stability has to be tested by growing a further generation or new seed stock to verify that it exhibits the same characteristics as those shown by the previous variety supplied. (International Union for the Protection of New Varieties of Plants, *Revised General Introduction to the Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability of New Varieties of Plants,* revised by the Technical Committee on 14th November 1979, document C/XIV/9, reproduced from TG/1/2.)

Some scholars point out problems with the DUS criteria. Byrne suggests that depending on the species to which a variety belongs, there may be little difficulty in distinguishing the applied for variety from the prior art.[64,65] Professor Smartt states that breeders of multiline varieties[66] may be faced with difficulties in satisfying the uniformity criterion.[67] Nevertheless, throughout the development of the UPOV Conventions and national PVR laws,[68] the DUS criteria remain the main features of PVR systems.[69] It is not open to the Thai government to modify the DUS

---

[64]Byrne, N. *Commentary on the Substantive Law of the 1991 UPOV Convention for the Protection of Plant Varieties,* Centre for Commercial Law Studies, Queen Mary and Westfield College, University of London, London, 1991, p. 35.

[65]See, for instance, *Maris Druid Spring Barley* [1968] Fleet Street Reports 559 where the applied for variety was distinct on the basis of its resistance to a certain strain of mildew, even though this resistance was difficult to determine in view of the variability of mildew strains.

[66]They are blends of different genotypes of broad compatibility most suitable for production in a country where climatic variation between successive growing seasons may be considerable.

[67]He explains a difficulty with registration of multiline is that the procedure is cumbersome if each individual of a multiline has to be registered separately. (Smartt, J. "Biological Problems in Meeting DUS Standards for Plant Variety Rights Registration" [1985] Plant Variety Protection 28.)

[68]The history of PVR protection shows that the protection was designed by breeders. During the creation of the UPOV Convention and its later revision, a number of plant breeders participated. For example, the International Association of Professional Plant Breeders for the Protection of Plant Varieties (ASSINSEL) made an active contribution throughout the development of the UPOV Convention. These breeders have agreed that the DUS criteria were suitable for PVR systems.

[69]A British survey in 1988 reveals that the DUS criteria do not pose much of an obstacle to the granting of a PVR certificate. Even breeders who had experienced rejection on the grounds of a failure to meet the requirements stated that they did not wish to see any changes made to the system of protection or the assessment of these requirements. (A survey of the views of the British plant breeding industry commissioned by the Common Law Institute of Intellectual Property Law in 1988 (the commissioned organisation was the Intellectual Property Law Unit, Queen Mary and Westfield College, University of London, under the direction of Byrne, N. and

criteria to accommodate plant breeding strategies in Thailand, first, because if the government decides to ratify the UPOV Convention, it must ensure that domestic PVR legislation implements all obligations laid down by the Convention: second, even if the government decides not to ratify the Convention, it will need domestic legislation based on either the 1978 or 1991 texts in order to comply with the TRIPs obligations.[70]

2.4.3. Variety denomination

The 1978 and 1991 UPOV Conventions require the breeder to submit a name or other denomination for the candidate variety to the granting authority.[71,72] The name is registered at the same time as PVR is granted.

Llewelyn, M.); cited in Llewelyn, M. *The Legal Protection of New Plant Varieties*, PhD thesis submitted to University of Wales, Aberystwyth, Dyfed, 29th September 1990.)

[70]See Chapters 3 and 4 for further discussion.

[71]Article 6(1)(e) and Article 13 of the 1978 UPOV text and Article 20 of the 1991 UPOV text in Appendix 2/1.

[72]Kunhardt states that the notion that a variety must have a variety denomination is not an invention of the fathers of the Convention. The basic principles for naming varieties, including the assumption that a variety denomination is the generic designation of the variety, already existed and these principles were simply incorporated into a PVR system to ensure that those principles would be observed under this system. (Kunhardt, H. "UPOV and Variety Denomination" [1984] 40 Plant Variety Protection 16, at 18.)

Varietal nomenclature predates the emergence of PVR system. Burdet provides that the need to distinguish plants and give them names has always existed. Man has striven to do it in all languages and according to all the systems of thought that have prevailed throughout his history. The modern era, which in this field dates back to the sixteenth century, is characterised by determination to make the various systems for the designation of plants into one universal system: search for common features and synonymity under Bauhin; dogmatic pragmatism and authoritarian schools of thought under Linnaeus or Lamarck. (Burdet, H.M. "The De Candolle

Variety denomination is obligatory in most PVR systems, particularly, in UPOV member States;[73] it must enable the variety to be identified. The UPOV Conventions define characteristics of a registrable denomination by reference to negative criteria.[74] The register of variety names exists to protect the public interest.[75,76] A PVR holder is not the proprietor of the registered name, but at most its guardian for the period of protection.[77] In addition to the use of a

---

Family and the Historical Development of Botanical Nomenclature" [1984] 40 Plant Variety Protection 3.)

In the 17th century, in France and the Netherlands it was common practice to adopt invented names when breeding new varieties. (Kunhardt, H. "UPOV and Variety Denominations" [1984] 40 Plant Variety Protection 16, at 17.)

[73]Variety denomination did not exist under the US Plant Variety Protection Act 1970 (as amended in 1980). However, Section 52 of the US Plant Variety Protection Act 1994 provides that an application for a certificate recognising plant variety rights shall contain the name of the variety except that a temporary designation will suffice until the certificate is to be issued. The variety shall be named in accordance with regulations issued by the Secretary.

[74]See Article 13(2) of the 1978 UPOV text and Article 20(2) of the 1991 UPOV text in Appendix 2/1. The criteria are: the denomination may not consist solely of figures except where this is an established practice for designating varieties; it must not be liable to mislead or to cause confusion concerning the characteristics, value or identity of the variety or the identity of the breeder; it must be different from every denomination which designates an existing variety of the same plant species or of a closely related species.

[75]It is meant to avoid public confusion about the identity of a variety. It is obligatory for anyone who commercialises the protected variety to use the registered name even after expiry of PVR.

[76]Kunhardt says that a variety denomination, once it is officially registered, is no longer under the breeder's control and shares to a greater extent the actual fate of the variety than the legal fate of PVR. The denomination has been adopted mainly in the public interest which is caused by the particularities of the subject of protection (plant varieties). (Kunhardt, H. "UPOV and Variety Denominations" [1984] 40 Plant Variety Protection 16, at 16.)

[77]Byrne explains that a PVR holder cannot prevent others from using the denomination on protected material of the variety in respect of which it is registered; and it may be used also on material of a variety of an unrelated species (unless a different denomination has been registered

registered variety name, plant varieties can be marketed under trade marks and trade names.[78]

2.5. PVR examination

A PVR system is voluntary in the sense that a breeder is under no legal obligation to file an application for the right. There must however be an official examination before the grant of PVR. The authority from which the rights are sought is responsible for administrative and technical examinations after an application is filed.

---

for this variety). PVR laws in many UPOV countries provide that it is a wrong actionable in proceedings by the PVR holder, for anyone to use a registered name, or a name so nearly resembling it as to be likely to deceived or cause confusion, to commercialise the reproductive material of a different variety within the same class as the protected variety. (Byrne, N. *Commentary on the Substantive Law of the 1991 UPOV Convention for the Protection of Plant Varieties,* Centre for Commercial Law Studies, Queen Mary and Westfield College, University of London, London, 1991, pp. 71-75.)

[78]Royon states: "Alongside the need for nomenclature, breeders have in addition to refer to trademark legislation. This is due, and indeed increasingly due, to the transformation of distribution circuits, marketing methods, the internationalisation of those methods and the necessity, for the professionals that they are, to provide better protection for their advertising investment" (Royon, R. "Variety Denominations and Trademarks" [1984] 40 Plant Variety Protection 26, at 28.)

See Article 13(8) of the 1978 UPOV text and Article 20(8) of the 1991 UPOV text in Appendix 2/1.

2.5.1. Administrative examination

A PVR applicant is required to submit an application form and a detailed technical questionnaire.[79] The first task of the authority is to examine whether it is dealing with a prima facie valid application. An applicant must describe the characteristics of his new variety and this description is used to guide the authority in conducting a DUS technical examination, including selection of suitable standard varieties for comparative purposes. An applicant is also required to supply prescribed quantities of seed or other reproductive material.

The authority is also responsible for examining variety denomination[80] and novelty. These examinations involve mainly administrative work and therefore require investment and infrastructures, e.g. a record of existing varieties and their denomination.

2.5.2. Technical examination

The technical examination of a variety is a unique feature of PVR systems. The PVR technical examination is designed to ensure that the variety meets the DUS criteria. The advantage of the test for breeders is that they may have confidence in

---

[79]The UPOV Guidelines recommend the contents of the "Technical Questionnaire" to be completed by a PVR applicant. They include species, name and address of applicant, proposed denomination of breeder's reference, information on the origin of the variety (method of maintenance of the variety), characteristics of the variety, similar varieties and differences from those varieties, and additional information which may help to distinguish the variety (e.g. resistance to pests and disease, and special conditions for the examination of the variety)

[80]In most PVR systems, the examination is carried out under certain rules of plant nomenclature established by UPOV. See Appendix 2/4 for guidelines for variety denomination.

the validity of their rights, since the test is carried out by competent authorities. This may be why there are few instances of post-grant challenges to the validity of PVR.

A variety is examined by growing it and observing its distinguishing characteristics over a period of time.[81] Neither the 1978 nor the 1991 UPOV Conventions require, by express provision, the granting authority itself to carry out the technical examination. In most PVR systems,[82] the test is conducted by the granting authority or its associated organisation.[83] This is a costly, lengthy and labour-intensive process,[84] and requires the granting authority to have, or have access to,

---

[81]A DUS technical examination normally takes 2 years for self-pollinated crops but cross-pollinated crops may require 3 years. (Harvey, J. et al. *The Plant Variety Testing and Seed Certification Systems in the United Kingdom*, Report to the Ministry of Agriculture, Fisheries and Food, and the Secretaries of State for Northern Ireland, Scotland and Wales, February 1988, p. 55.)

[82]In some countries e.g. the USA, Canada and Australia, PVR may be granted essentially on documentary evidence of growing tests or other trails carried out by the applicant or competent scientists. However, the authority may require a further growing test. For example, under the Australian Plant Breeder's Rights Act 1994, if the granting authority decides that there should be a growing test, it (or an approved person) may conduct the test or make arrangements for an approved person to supervise testing.

[83]For example, in the UK a breeder submits a PVR application to the Plant Variety Rights Office at Cambridge. The Office determines whether it is dealing with a *prima facie* valid application. If so, the National Institute of Agricultural Botany (NIAB) carries out a DUS technical test.

[84]A DUS test is conducted on an individual basis. Considerable care is required in producing the test plants to avoid any bias which might result from any effect of locally unfavourable conditions during growth and development. In the case of perennial ryegrass, for instance, 72 seeds are sown individually in small pots under glass in the Spring. At the beginning of July, 60 of the plants produced are chosen at random and planted in the field. (Harvey, J. et al. *The Plant Variety Testing and Seed Certification Systems in the United Kingdom*, Report to the Ministry of Agriculture, Fisheries and Food, and the Secretaries of State for Northern Ireland, Scotland and Wales, February 1988, p. 56.)

suitable testing facilities, technically competent personnel and a collection of reference varieties for the examination.

For a developing country like Thailand, the UPOV requirement that a variety be examined in growing trials gives rise to these considerations.

Location: Each plant species requires individual planting conditions. In theory there should be various testing fields suitable for different species. This disaggregated system is costly. However, a single testing field for all species has shortcomings.[85] In the UK, each species, except cereals, is currently tested at a single site which varies according to the species.[86]

Finance: The implementation of a PVR system is costly, due mainly to the infrastructure needed for a technical examination. The cost is partly contributed by the government. The cost may be lower in the US, Australia and Canada since

---

[85]The disadvantages are:

(1) Some species cannot best display their characteristics at a testing site. For example, lychees indigenous to the Northern part of Thailand can be grown in other parts of the country but cannot produce fruits.

(2) A single testing field can be at risk from pests, diseases and the weather.

[86]

Species	Testing site
Cereal	NIAB at Cambridge and DAFS at East Craigs, Edinburgh
Herbage	Crossnacreevy in Northern Ireland
Roots and vegetables	NIAB Cambridge with the exceptions of peas, carrots, leeks, swedes and turnips which are tested at DAFS, East Craigs Edinburgh
Potatoes	
Fruit crops	MAFF Experimental Horticulture Station, Brogdale Farm, Faversham
Ornamentals and decoratives	The Royal National Rose Society at St. Albans and NIAB

technical examinations are not carried out by the authority but by competent scientists.[87] A PVR applicant is responsible for the entire cost of the test.

Infrastructure: The most important infrastructure for DUS test is trained staff. A candidate variety is grown for certain successive planting reasons. The technique employed is simple but labour-extensive; a variety is grown along with reference varieties.

2.6. Competent granting authorities

PVR systems throughout the world are normally implemented by one of the following organisations:

(1) Ministries of Agriculture or specially created organisations: In most UPOV member States (e.g. the Netherlands, Denmark and France), PVR systems are administered by Ministries of Agriculture because of their technological capability in conducting DUS technical tests. Some countries have established special organisations responsible for the implementation. For instance, the German PVR system is administered by the Bundessortenamt which is an independent Federal Authority responsible to the Federal Minister of Food, Agriculture and Forestry.

(2) Patent Offices or offices subordinate to Ministries of Commerce: In Italy and Hungary, where all administrative work is done by the Patent Offices, the Ministry of Agriculture undertakes the testing of varieties. The New Zealand Plant Variety

---

[87]A PVR applicant has to provide the PVR authority with descriptive data relating to his candidate variety. The data are acceptable if only they are derived from properly designed trails, using the appropriate controls for comparison purpose and following the UPOV guidelines for the species concerned. In all cases the national office is entitled to visit trails to see growing samples of candidate varieties.

Rights Office is under the Ministry of Commerce which oversees all intellectual property matters.

In selecting the most appropriate PVR office, it is necessary to consider various factors, such as the administrative, technological and financial strength of possible candidates. In some cases, political influence plays a vital role.[88]

---

[88]An option for the most appropriate Thailand's PVR Office is to be discussed in Chapters 3 and 8.

Conclusion

Plant breeders for many years sought intellectual property protection for their newly developed varieties. In 1961 the UPOV Convention introduced PVR, a special form of plant variety protection. The 1961 Convention was later amended by the Additional Act of 1972, consolidated in the 1978 Convention and revised in 1991. At present, PVR systems have been implemented in many developed and developing countries.

PVR is a special form of intellectual property. It enables the right proprietor to prevent those without authorisation from committing certain acts with regard to a protected variety. In striking the balance between public and private interests, PVR law has safeguards against undue monopolisation, including statutory exemptions, compulsory licensing and exhaustion of rights.

To be protected by PVR law, a variety must meet the criteria of novelty, distinctness, uniformity and stability. The law also requires a variety to be denominated. A varietal nomenclature must enable a variety to be identified.

PVR's unique feature is the DUS technical examination. Normally a candidate variety must be grown and tested by the authority or a competent scientist in order to ensure that it satisfies the prescribed criteria. This makes a PVR system protracted and costly and in some countries PVR applicants bear the burden.

The main difference between the 1978 and 1991 UPOV Conventions is the scope of protection, which under the 1991 text covers a wider array of protectable subject matter and infringing acts. The revision of the 1991 Act aims to keep pace

with the development of biotechnological techniques and their increasing application in plant breeding programmes. It remains to be seen whether the new text will achieve its stated aim of providing adequate protection, or wherever, as has been suggested, it will actually have undesirable consequences.

Appendix 2/1

Some main provisions of the 1978 and 1991 UPOV Conventions

Text of the 1978 UPOV Convention

Article 2: Forms of protection; meaning of variety

(1) Each member State of the Union may recognise the right of the breeder provided for in this Convention by the grant either of a special title of protection or of a patent. Nevertheless, a member State of the Union whose national law admits of protection under both these forms may provide only one of them for one and the same botanical genus or species.

(2) Each member State of the Union may limit the application of this Convention within a genus or species to varieties with a particular manner of reproduction or multiplication, or a certain end-use.

Article 3: National treatment; reciprocity

(1) Without prejudice to the rights specially provided for in this Convention, natural and legal persons resident or having their registered office in one of the member States of the Union shall, in so far as the recognition and protection of the right of the breeder are concerned, enjoy in the other member States of the Union the same treatment as is accorded or may hereafter be accorded by the respective laws of such States to their own nationals, provided that such persons comply with the conditions and formalities imposed on such nationals.

(2) Nationals of member States of the Union not resident or having their registered office in one of those States shall likewise enjoy the same rights provided that they fulfil such obligations as may be imposed on them for the purpose of enabling the varieties which they have bred to be examined and the multiplication of such varieties to be checked.

(3) Notwithstanding the provisions of paragraphs (1) and (2), any member State of the Union applying this Convention to given genus or species shall be entitled to limit the benefit of the protection to the nationals of those member States of the Union which apply this Convention to that genus or species and to natural and legal persons resident or having their registered office in any of those States.

Article 4: Botanical genera and species which must or may be protected

(1) This Convention may be applied to all botanical genera and species.

(2) The member States of the Union undertake to adopt all measures necessary for the progressive application of the provisions of this Convention to the largest possible number of botanical genera and species.

(3) (a) Each member State of the Union shall, on the entry into force of this Convention in its territory, apply the provisions of the Convention to at least five of the genera or species.

(b) Subsequently, each member State of the Union shall apply the said provisions to additional genera or species within the following periods from the date of the entry into force of this Convention in its territory:

(a) within three years, to at least ten genera or species in all;

(b) within six years, to at least eighteen genera or species in all;

(c) within eight years, to at least twenty-four genera or species in all.

(c) If a member State of the Union has limited the application of this Convention within a genus or species in accordance with the provisions of Article 2(2), that genus or species shall nevertheless, for the purposes of subparagraphs (a) and (b), be considered as one genus or species.

(4) At the request of any State intending to ratify, accept, approve or accede to this Convention, the Council may, in order to take account of special economic or ecological conditions prevailing

in that State, decide, for the purpose of that State, to reduce the minimum numbers referred to in paragraph (3), or to extend the periods referred to in that paragraph, or to do both.
(5) At the request of any member State of the Union, the Council may, in order to take account of special difficulties encountered by that State in the fulfilment of the obligations under paragraph (3)(b), decide, for the purposes of that State, to extend the periods referred to in paragraph (3)(b).

Article 5: Rights protected; scope of protection

(1) The effect of the right granted to the breeder is that his prior authorisation shall be required for

- the production for purposes of commercial marketing
- the offering for sale
- the marketing

of the reproductive or vegetative propagating material, as such, of the variety.
Vegetative propagating material shall be deemed to include whole plants. The right of the breeder shall extend to ornamental plants or parts thereof normally marketed for purposes other than propagation when they used commercially as propagating material in the production of ornamental plants or cut flowers.
(2) The authorisation given by the breeder may be made subject to such conditions as he may specify.
(3) Authorisation by the breeder shall not be required either for the utilisation of the variety as an initial source of variation for the purpose of creating other varieties or for the marketing of such varieties. Such authorisation shall be required, however, when the repeated use of the new variety is necessary for the commercial production of another variety.
(4) Any member State of the Union may, either under its own law or by means of special agreements under Article 29, grant to breeders, in respect of certain botanical genera or species, a more extensive right than that set out in paragraph (1), extending in particular to the marketed product. A member State of the Union which grants such a right may limit the benefit of it to the nationals of member States of the Union which grant an identical right and to natural and legal persons resident or having their registered office in any of those States.

Article 6: Conditions required for protection

(1) The breeder shall benefit from the protection provided for in this Convention when the following conditions are satisfied:

(a) Whatever may be the origin, artificial or natural, of the initial variation from which it has resulted, the new variety must be clearly distinguishable by one or more important characteristics from any other variety whose existence is a matter of common knowledge at the time when protection is applied for.
Common knowledge may be established by reference to various factors such as: cultivation or marketing already in progress, entry in an official register of varieties already made or in the course of being made, inclusion in a reference collection, or precise description in a publication. The characteristics which permit a variety to be defined and distinguished must be capable of precise recognition and description.
(b) At the date on which the application for protection in a member State of the Union is filed, the variety
(i) must not - or, where the law of that State so provides, must not for longer than one year - have been offered for sale or marketed, with the agreement of the breeder, in the territory of that State, and
(ii) must not have been offered for sale or marketed, with the agreement of the breeder, in the territory of any other State for longer than six years in the case of vines, forest trees, fruit trees and ornamental trees, including, in each case, their rootstocks, or for longer than four years in the case of all other plants.
Trails of the variety not involving offering for sale or marketing shall not affect the right to protection. The fact that the variety has become a matter of common knowledge in ways other than through offering for sale or marketing shall also not affect the right of the breeder to protection.

(c) The variety must be sufficiently homogeneous, having regard to the particular features of its sexual reproduction or vegetative propagation.
(d) The variety must be stable in its essential characteristics, that is to say, it must remain true to its description after repeated reproduction or propagation or, where the breeder has defined a particular cycle of reproduction or multiplication, at the end of each cycle.
(e) The variety shall be given a denomination as provided in Article 13.

(2) Provided that the breeder shall have complied with the formalities provided for by the national law of the member State of the Union in which the application for protection was filed. including the payment of fees, the grant of protection may not be made subject to conditions other than those set forth above.

Article 7: Official examination of new varieties; Provisional protection

(1) Protection shall be granted only after examination of the variety in the light of the criteria defined in Article 6. Such examination shall be appropriate to each botanical genus or species.
(2) For the purposes of such examination, the competent authorities of each member State of the Union may require the breeder to furnish all the necessary information, documents, propagating material or seeds.
(3) Any member State of the Union may provide measures to protect the breeder against abusive acts of third parties committed during the period between the filing of the application for protection and the decision thereon.

Article 8: Period of protection

The right conferred on the breeder shall be granted for a limited period. This period may not be less than fifteen years, computed from the date of issue of the title of protection. For vines, forest trees, fruit trees and ornamental trees, including, in each case, their rootstocks, the period of protection may not be less than eighteen years, computed from the said date.

Article 9: Restrictions in the exercise of rights protected

(1) The free exercise of the exclusive right accorded to the breeder may not be restricted otherwise than for reasons of public interest.
(2) When any such restriction is made in order to ensure the widespread distribution of the variety, the member State of the Union concerned shall take all measures necessary to ensure that the breeder receives equitable remuneration.

Article 13: Denomination of new varieties of plants

(1) The variety shall be designated by a denomination destined to be its generic designation. Each member State of the Union shall ensure that subject to paragraph (4) no rights in the designation registered as the denomination of the variety shall hamper the free use of the denomination in connection with the variety, even after the expiration of the protection.
(2) The denomination must enable the variety to be identified. It may not consist solely of figures except where this is an established practice for designating varieties. It must not be liable to mislead or to cause confusion concerning the characteristics, value or identity of the variety or the identity of the breeder. In particular, it must be different from every denomination which designates, in any member State of the Union, an existing variety of the same botanical species or of a closely related species.
(3) The denomination of the variety shall be submitted by the breeder to the authority referred to in Article 30(1)(b). If it is found that such denomination does not satisfy the requirements of paragraph (2), that authority shall refuse to register it and shall require the breeder to propose another denomination within a prescribed period. The denomination shall be registered at the same time as the title of protection is issued in accordance with the provisions of Article 7.
(4) Prior rights of third parties shall not be affected. If, by reason of a prior right, the use of the denomination of a variety is forbidden to a person who, in accordance with the provisions of paragraph (7), is obliged to use it, the authority referred to in Article 30(1)(b) shall require the breeder to submit another denomination for the variety.
(5) A variety must be submitted in member States of the Union under the same denomination. The authority referred to in Article 30(1)(b) shall register the denomination so submitted, unless

it considers that denomination unsuitable in its State. In the latter case, it may require the breeder to submit another denomination.

(6) The authority referred to in Article 30(1)(b) shall ensure that all the other such authorities are informed of matters concerning variety denominations, in particular the submission, registration and cancellation of denominations. Any authority referred to in Article 30(1)(b) may address its observations, if any, on the registration of a denomination to the authority which communicated that denomination.

(7) Any person who, in a member State of the Union, offers for sale or markets reproductive or vegetative propagating material of a variety protected in that State shall be obliged to use the denomination of that variety, even after the expiration of the protection of that variety, in so far as, in accordance with the provisions of paragraph (4), prior rights do not prevent such use.

(8) When the variety is offered for sale or marketed, it shall be permitted to associate a trade mark, trade name or other similar indication with a registered variety denomination. If such an indication is so associated, the denomination must nevertheless be easily recognisable.

Text of the 1991 UPOV Convention (As adopted unanimously on 19th March 1991)

Article 1: Definition

(iv) "breeder" means

- the person who bred, or discovered and developed, a variety
- the person who is the employer of the aforementioned person or who has commissioned the latter's work, where the laws of the relevant Contracting Party so provide, or
- the successor in title of the first or second aforementioned person, as the case may be.

(vi) "variety" means a plant grouping within a single botanical taxon of the lowest known rank, which grouping, irrespective of whether the conditions for the grant of a breeder's right are fully met, can be

- defined by the expression of the characteristics resulting from a given genotype or combination of genotypes,
- distinguished from any other plant grouping by the expression of at least one of the said characteristics and
- considered as a unit with regard to its suitability for being propagated unchanged.

Article 2: Basic obligation of the Contracting Parties

Each Contracting Party shall grant and protect breeder's rights.

Article 3: Genera and species to be protected

(1) [States already members of the Union] Each Contracting Party which is bound by the Act of 1961/1972 or the Act of 1978 shall apply the provisions of this Convention,

(i) at the date on which it becomes bound by this Convention, to all plant genera and species to which it applies, on the said date, the provisions of the Act of 1961/1972 or the Act of 1978 and,

(ii) at the latest by the expiration of a period of five years after the said date, to all plant genera and species.

(2) [New members of the Union] Each Contracting Party which is not bound by the Act of 1961/1972 or the Act of 1978 shall apply the provisions of this Convention,

(i) at the date on which it becomes bound by this Convention, to at least 15 plant genera or species and,

(ii) at the latest by the expiration of a period of 10 years from the said date, to all plant genera and species.

Article 4: National treatment

(1) [Treatment] Without prejudice to the rights specified in this Convention, nationals of a Contracting Party as well as natural persons resident and legal entities having their registered offices within the territory of a Contracting Party shall, in so far as the grant and protection of breeders' rights are concerned, enjoy within the territory of each other Contracting Party the same treatment as is accorded or may hereafter be accorded by the laws of each such other Contracting Party to its own nationals, provided that the said nationals, natural persons or legal entities comply with the conditions and formalities imposed on the nationals of the said other Contracting Party.

(2) ["Nationals"] For the purposes of the preceding paragraph, "nationals" means, where the Contracting Party is a State, the nationals of that State and, where the Contracting Party is an intergovernmental organisation, the nationals of the States which are members of that organisation.

Article 5: Conditions of protection

(1) [Criteria to be satisfied] The breeder's right shall be granted where the variety is

(i) new,

(ii) distinct,

(iii) uniform and

(iv) stable.

(2) [Other conditions] The grant of the breeder's right shall not be subject to any further or different conditions, provided that the variety is designated by a denomination in accordance with the provisions of Article 20, that the applicant complies with the formalities provided for by the law of the Contracting Party with whose authority the application has been filed and that he pays the required fees.

Article 6: Novelty

(1) [Criteria] The variety shall be deemed to be new if, at the date of filing of the application for a breeder's right, propagating or harvested material of the variety has not been sold or otherwise disposed of to others, by or with the consent of the breeder, for the purposes of exploitation of the variety

(i) in the territory of the Contracting Party in which the application has been filed earlier than one year before that date and

(ii) in a territory other than that of the Contracting Party in which the application has been filed earlier than four years or, in the case of trees or of vines, earlier than six years before the said date.

(2) [Varieties of recent creation] Where a Contracting Party applies this Convention to a plant genus or species to which it did not previously apply this Convention or an earlier Act, it may consider a variety of recent creation existing at the date of such extension of protection to satisfy the condition of novelty defined in paragraph (1) even where the sale or disposal to others described in that paragraph took place earlier than the time limits defined in that paragraph.

(3) ["Territory" in certain cases] For the purposes of paragraph (1), all the Contracting Parties which are member States of one and the same intergovernmental organisation may act jointly, where the regulations of that organisation so require, to assimilate acts done on the territories of the States members of that organisation to acts done on their own territories and, should they do so, shall notify the Secretary-General accordingly.

Article 7: Distinctness

The variety shall be deemed to be distinct if it is clearly distinguishable from any other variety whose existence is a matter of common knowledge at the time of the filing of the application. In particular, the filing of an application for the granting of a breeder's right or for the entering of another variety in an official register of varieties, in any country, shall be deemed to render that other variety a matter of common knowledge from the date of the application, provided that the application leads to the granting of a breeder's right or to the entering of the said other variety in the official register of varieties, as the case may be.

Article 8: Uniformity

The variety shall be deemed to be uniform if, subject to the variation that may be expected from the particular features of its propagation, it is sufficiently uniform in its relevant characteristics.

Article 9: Stability

The variety shall be deemed to be stable if its relevant characteristics remain unchanged after repeated propagation or, in the case of a particular cycle of propagation, at the end of each such cycle.

Article 12: Examination of the application

Any decision to grant a breeder's right shall require an examination for compliance with the conditions under Articles 5 to 9. In the course of the examination, the authority may grow the variety or carry out other necessary tests, cause the growing of the variety or the carrying out of other necessary tests, or take into account the results of growing tests or other trials which have already been carried out. For the purposes of examination, the authority may require the breeder to furnish all the necessary information, documents or material.

Article 14: Scope of the breeder's right

(1) [Acts in respect of the propagating material] (a) Subject to Articles 15 and 16, the following acts in respect of the propagating material of the protected variety shall require the authorisation of the breeder:

(i) production or reproduction (multiplication),
(ii) conditioning for the purpose of propagation,
(iii) offering for sale,
(iv) selling or other marketing,
(v) exporting,
(vi) importing,
(vii) stocking for any of the purposes mentioned in (i) to (vi) above.

(b) The breeder may make his authorisation subject to conditions and limitations.

(2) [Acts in respect of the harvested material] Subject to Articles 15 and 16, the acts referred to in items (i) to (vii) of paragraph (1)(a) in respect of harvested material, including entire plants and parts of plants, obtained through the unauthorised use of propagating material of the protected variety shall require the authorisation of the breeder, unless the breeder has had reasonable opportunity to exercise his right in relation to the said propagating material.

(3) [Acts in respect of certain products] Each Contracting Party may provide that, subject to Articles 15 and 16, the acts referred to in items (i) to (vii) of paragraph (1)(a) in respect of products made directly from harvested material of the protected variety falling within the provisions of paragraph (2) through the unauthorised use of the said harvested material shall require the authorisation of the breeder unless the breeder has had reasonable opportunity to exercise his right in relation to the said harvested material.

(4) [Possible additional acts] Each Contracting Party may provide that, subject to Articles 15 and 16, acts other than those referred to in items (i) to (vii) of paragraph (1)(a) shall also require the authorisation of the breeder.

(5) [Essentially derived and certain other varieties]

(a) The provisions of paragraphs (1) to (4) shall also apply in relation to

(i) varieties which are essentially derived from the protected variety, where the protected variety is not itself an essentially derived variety,
(ii) varieties which are not clearly distinguishable in accordance with Article 7 from the protected variety and
(iii) varieties whose production requires the repeated use of the protected variety.

(b) For the purposes of sub-paragraph (a)(i), a variety shall be deemed to be essentially derived from another variety ("the initial variety") when

(i) it is predominantly derived from the initial variety, or from a variety that is itself predominantly derived from the initial variety, while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety,
(ii) it is clearly distinguishable from the initial variety and
(iii) except for the differences which result from the act of derivation, it conforms to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety.

(c) Essentially derived varieties may be obtained for example by the selection of a natural or induced mutant, or of a somaclonal variant, the selection of a variant individual from plants of the initial variety, backcrossing, or transformation by genetic engineering.

Article 15: Exceptions to the breeder's right

(1) [Compulsory exception] The breeder's right shall not extend to

(i) acts done privately and for non-commercial purposes,
(ii) acts done for experimental purposes and
(iii) acts done for the purpose of breeding other varieties, and, expect where the provisions of Article 14(5) apply, acts referred to in Article 14(1) to (4) in respect of such other varieties.

(2) [Optional exception] Notwithstanding Article 14, each Contracting Party may, within reasonable limits and subject to the safeguarding of the legitimate interests of the breeder, restrict the breeder's right in relation to any variety in order to permit farmers to use for propagating purposes, on their own holdings, the product of the harvest which they have obtained by planting, on their own holdings, the protected variety or a variety covered by Article 14(5)(a)(i) or (ii).

Article 16: Exhaustion of the breeder's right

(1) [Exhaustion of right] The breeder's right shall not extend to acts concerning any material of the protected variety, or of a variety covered by the provisions of Article 14(5), which has been sold or otherwise marketed by the breeder or with his consent in the territory of the Contracting Party concerned, or any material derived from the said material, unless such acts

(i) involve further propagation of the variety in question or

(ii) involve an export of material of the variety, which enables the propagation of the variety, into a country which does not protect varieties of the plant genus or species to which the variety belongs, except where the exported material is for final consumption purposes.

(2) [Meaning of "material"] For the purposes of paragraph (1), "material" means, in relation to a variety,

(i) propagating material of any kind,

(ii) harvested material, including entire plants and parts of plants, and

(iii) any product made directly from the harvested material.

(3) ["Territory" in certain cases] For the purposes of paragraph (1), all Contracting Party which are member States of one and the same intergovernmental organisation may act jointly, where the regulations of that organisation so require, to assimilate acts done on the territories of the States members of that organisation to acts done on its own territory and, should they do so, shall notify the Secretary-General accordingly.

Article 17: Restrictions on the exercise of the breeder's right

(1) [Public interest] Except where expressly provided in this Convention, no Contracting Party may restrict the free exercise of a breeder's right other than for reasons of public interest.

(2) [Equitable remuneration] When any such restriction has the effect of authorising a third party to perform any act for which the breeder's authorisation is required, the Contracting Party concerned shall take all measures necessary to ensure that the breeder receives equitable remuneration.

Article 19: Duration of the breeder's right

(1) [Period of protection] The breeder's right shall be granted for a fixed period.

(2) [Minimum period] The said period shall not be shorter than 20 years from the date of the grant of the breeder's right. For trees and vines, the said period shall not be shorter than 25 years from the said date.

Article 20: Variety denomination

(1) [Designation of varieties by denominations; Use of the denomination] (a) The variety shall be designated by a denomination which will be its generic designation.

(b) Each Contracting Party shall ensure that, subject to paragraph (4), no rights in the designation registered as the denomination of the variety shall hamper the free use of the denomination in connection with the variety, even after the expiration of the breeder's right.

(2) [Characteristics of the denomination] The denomination must enable the variety to be identified. It may not consist solely of figures except where this is an established practice for designating varieties. It must not be liable to mislead or to cause confusion concerning the characteristics, value or identity of the variety or the identity of the breeder. In particular, it must be different from every denomination which designates, in the territory of any Contracting Party, an existing variety of the same plant species or of a closely related species.

(3) [Registration of the denomination] The denomination of the variety shall be submitted by the breeder to the authority. If it is found that denomination does not satisfy the requirements of paragraph (2), the authority shall refuse to register it and shall require the breeder to propose another denomination within a prescribed period. The denomination shall be registered by the authority at the same time as the breeder's right is granted.

(4) [Prior rights of third persons] Prior rights of third persons shall not be affected. If, by reason of a prior right, the use of the denomination of a variety is forbidden to a person who, in accordance with the provisions of paragraph (7), is obliged to use it, the authority shall require the breeder to submit another denomination for the variety.

(5) [Same denomination in all Contracting Parties] A variety must be submitted to all Contracting Parties under the same denomination. The authority of each Contracting Party shall register the denomination so submitted, unless it considers the denomination unsuitable within its territory. In the latter case, it shall require the breeder to submit another denomination.

(6) [Information among the authorities of Contracting Parties] The authority of a Contracting Party shall ensure that the authorities of all the other Contracting Parties are informed of matters concerning variety denominations, in particular the submission, registration and cancellation of denominations. Any authority may address its observations, if any, on the registration of a denomination to the authority which communicated that denomination.

(7) [Obligation to use the denomination] Any person who, within the territory of one of the Contracting Parties, offers for sale or markets propagating material of a variety protected within the said territory shall be obliged to use the denomination of that variety, even after the expiration of the breeder's right in that variety, except where, in accordance with the provisions of paragraph (4), prior rights prevent such use.

(8) [Indications used in association with denomination] When a variety is offered for sale or marketed, it shall be permitted to associate a trade mark, trade name or other similar indication with a registered variety denomination. If such an indication is so associated, the denomination must nevertheless be easily recognisable.

Features	1978 UPOV text	1991 UPOV text
Subject matter	Plant varieties of certain plant species	Plant varieties of all genera and species
Statutory requirements	Novelty, distinctness, uniformity and stability	Novelty, distinctness, uniformity and stability
Scope of protection - Protectable subject matter	Propagating material	Propagating material Harvested material Products made directly from harvested material Essentially derived and certain other varieties
-Infringing acts	Production for purposes of commercial marketing Offering for sale Marketing	Production or reproduction Conditioning for the purpose of propagation Offering for sale Selling or other marketing Exporting Importing Stocking for any of the aforementioned purposes
Statutory exemptions	Breeder's exemption	Breeder's exemption Farmer's exemption Experimental use Private and non-commercial use
Compulsory licensing	Available	Available
Exhaustion of right	No	Available

Appendix 2/2

Relationship between PVR, National Listing and Seed Certification

In the UK, the relationship between PVR, seed certification and national listing (NL) systems is complicated. The first two systems are under the 1964 Plant Varieties and Seed Act whereas NL is implemented under the Seeds (National Lists of Varieties) Regulations 1982.

Seed certification regulates the marketing, or the importation or exportation, of seed or any related activities (whether by reference to officially published lists of permitted varieties or otherwise). It is an offence for anyone to sell, or offer for sale, seed which does not meet prescribed requirements, e.g. purity and germination.

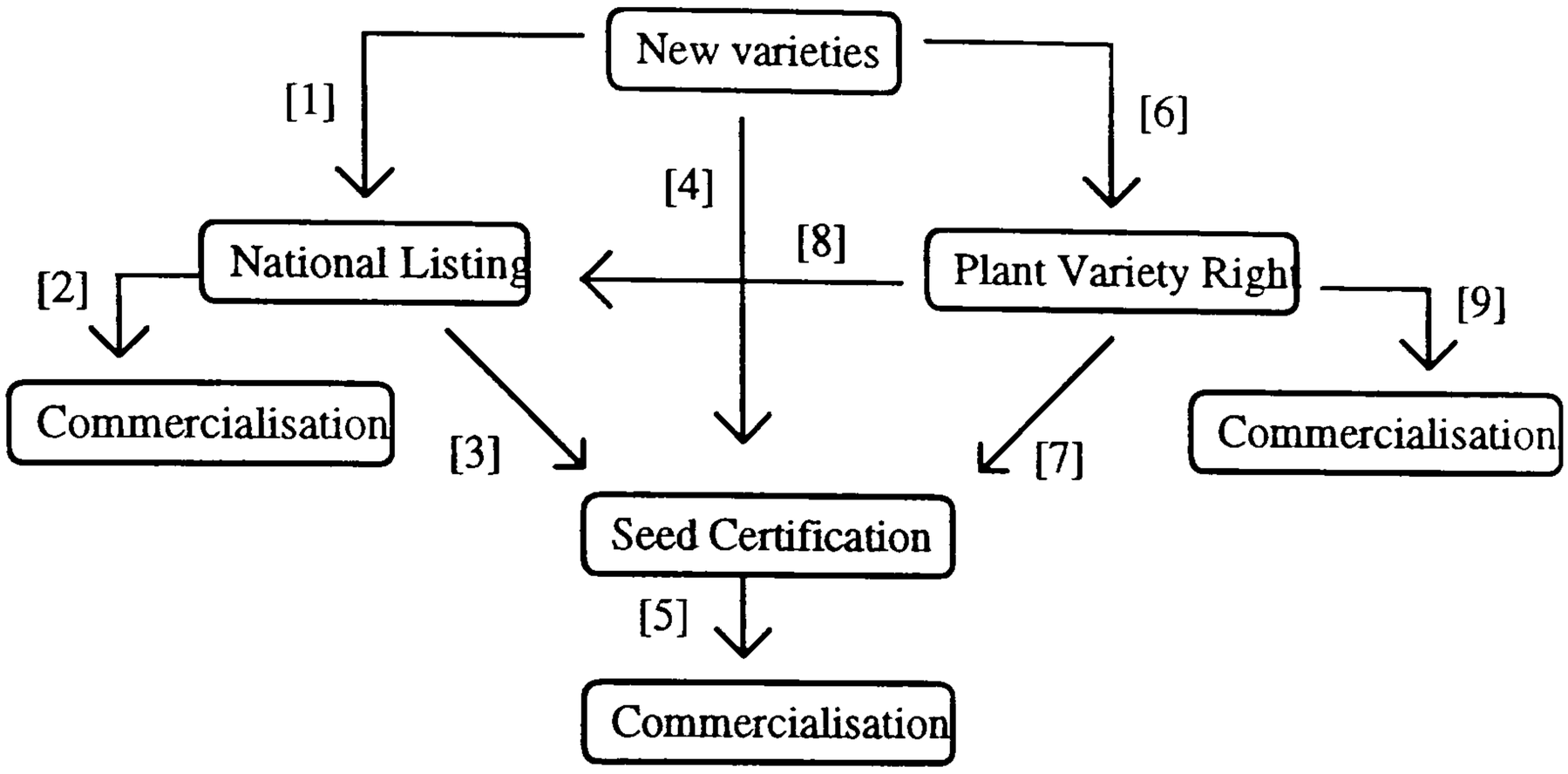
The 1982 Regulations prescribe specific plant species for which entry on NL is prerequisite of variety commercialisation. The varieties must meet statutory conditions: DUS[89] and Value for Cultivation and Use (VCU).[90]

---

[89]A PVR-DUS test is acceptable under NL.

[90]The VCU requirement provides that a variety must show a clear improvement in agronomic values over varieties which already appear on NL.

Contours of commercial interaction between PVR, NL and Seed Certification



Explanation

[1]-[2] a breeder commercialises his new variety; but certain varieties are those of which commercialisation must get NL approval.

[1]-[3]-[5] the seed commercialisation of certain aforementioned varieties must be certified.

[4]-[5] the seed commercialisation of certain new varieties is not required to get NL approval; but their seed certification is still prerequisite of the commercialisation.

[6]-[7]-[5] a breeder seeks PVR protection for certain new varieties and the seed commercialisation of these protected varieties must get approval under a seed certification system.

[6]-[8]-[2] the commercialisation of certain protected varieties must get approval under NL.

[6]-[8]-[3]-[5] the seed commercialisation of certain PVR protected varieties is required to get approval under both NL and seed certification.

[6]-[9] the commercialisation of some new varieties may not be required to get approval under NL and seed certification; but a breeder mat seek PVR protection for his new variety.

Appendix 2/3

Essentially derived varieties

An extract from

Document prepared by the Office of the International Union for the Protection of New Varieties of Plants, Geneva, Switzerland

Examples of essentially derived varieties[91]

In defining the term "essentially derived varieties", the 1991 UPOV Diplomatic Conference emphasised the principle that the definition should strike a proper balance between the interests of a breeder of an initial variety (a protected variety) and other breeders who may make recourse to the protected variety as a source of genetic variation. The broad definition which is favourable to a breeder of an initial variety may deter the development of new varieties; it increases the possibility that others will commit infringing acts.

Explanation:

1. "where the protected variety is not itself an essentially derived variety" (Article 14(5)(a)(i): The underlined words relate to a situation where, for example, Variety C is essentially derived from Variety B which is in turn essentially derived from Variety A. The words make clear that Variety C does not fall within the scope of the protection of Variety B; the words are not intended and should not be interpreted to require the right proprietor to positively prove that the protected variety is not itself an essentially derived variety before he is able to exercise the rights conferred by Article 14(5)(a)(i). The words provide an opportunity for the breeder of an alleged "essentially derived variety" to show that the initial variety is itself an essentially derived variety.

---

[91]Cited in Baenziger, P.S. et al (eds.) *Intellectual Property Rights: Protection of Plant Materials*, CSSA Special Publication No. 21, sponsored by Crop Science Society of America et al., Madison, USA, 1993, pp. 159-172.

2. "predominantly derived from the initial variety"

Article 14(5)(b)(i): The requirement of predominant derivation from an initial variety means that a variety can only be essentially derived from one variety. Discussions of the revision proposals in the sessions of the Administrative and Legal Committee which preceded the adoption by the Council in October 1990 of a draft Convention consistently showed that the intention was that a variety should only be essentially derived from another variety when it retained virtually the whole genotype of the other variety. This is confined by the words commented upon in paragraph 3 below. A derived variety could not in practice retain the expression of the essential characteristics of the variety from which it is derived unless it is almost entirely derived from that variety.

3. "while retaining the expression of the essential characteristics"

The essential characteristics are those which are indispensable or fundamental to the variety. "Characteristics" would seem to embrace all features of a variety including, for example, morphological, physiological, agronomic, industrial and biochemical characteristics. It is suggested that the result of a biochemical test conducted on a variety, for instance, a screening test using a genetic probe, is a characteristics of the variety. "While retaining" requires that the expression of the essential characteristics to be derived from the initial variety.

4 "that result from the genotype"

These words make clear that only characteristics of a variety which are heritable genetically should be taken into account. Any descriptive features of plant material that represent environmental arising from the use of a genetic probe is a characteristic that "result from the genotype". It has been suggested that the test result of using such a probe "result from the genotype".

5. "(ii) it is clearly distinguishable from the initial variety"

These words establish that essential derivation is concerned only with varieties that are clearly distinguishable from an initial variety and which are accordingly protected independently from the initial variety.

6. "(iii) except from the differences which result from the act of derivation it conforms to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the original variety"

The words "except for the differences which result from the act of derivation" do not set a limit to the amount of differences which may exist where a variety is considered to be essentially derived. A limit is, however, set by the words of subparagraph (i). The differences must not be such that the variety fails "to retain the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety". A comparison between subparagraphs (i) and (iii) of Article 14(5)(b) is somewhat problematic in that (i) would seem to require the whole of the expression of the essential characteristics that result from the genotype of the initial variety while (iii) requires only that the derived variety conform to the initial variety except for differences resulting from the act of derivation. the examples of essential derivation given in Article 14(5)(c) make clear that the differences which result from the act of derivation should be one or very few.

Appendix 2/4

Guidelines for variety denominations

Article 1:
(1) A variety shall be designated by only one denomination.
(2) If a variety has already been submitted for registration or registered in a member State of the Union for the Protection of New Plant Varieties, only the denomination under which the variety has been registered in that State can be accepted in the other member States unless the authority which has to decide on the new application considers the denomination unsuitable for linguistic or other reasons.

Article 2:
The denomination must make it possible to identify the new variety without risk of confusing a purchaser of average attentiveness.

Article 3:
(1) The denomination must consist of one to three words with or without a pre-existing meaning, easy to pronounce and to remember and capable of being used as the genetic name of the variety.
(2) Figures to a maximum of 4 may be included in a denomination if they have a meaning in connection with the word or words they refer to.
(3) A denomination may not be formed by substituting figures for other figures included in a denomination already in use, or by adding figures to a denomination or by omitting figures from it.
Where a variety is exclusively used for the production of propagating material of other varieties, its denomination may also be formed by combining letters and figures, provided that in the opinion of the competent authorities such combinations are established international custom for the species concerned.

Article 4:
A denomination may not embody any element which, on expiration of the term of protection of the variety, would prevent or hamper the free use of such denomination, or would prevent the free commercialisation of the variety.

Article 5:
The denomination must in particular not:
(1) be liable to deceive or cause confusion as to the origin, derivation, characteristics or value of the variety or identity of the breeder;
(2) refer solely to attributes which are also common to other varieties of the species concerned;
(3) be liable to give offence;
(4) be unsuitable for linguistic reasons.

Article 6:
The denomination may not consist of the botanical or common name of a species or genus; neither may it include the botanical or common name of a species or genus where this is likely to deceive or to cause confusion.

Article 7:
The denomination must not be the same as that of any other variety belonging to a species of the same class as prescribed in Appendix I(A), nor so nearly resemble it as to likely to deceive or to cause confusion.

Article 8:
The denomination must not suggest that the variety concerned is derived from or related to another variety when this is not the case.

Article 9:
The denomination must not include words such as "variety", "cultivar", "form", "hybrid" and "cross" or translations of such words.
Article 10:
A new variety may not be given a denomination which has been applied previously to a variety belonging to a species of the same class as prescribed in Appendix I(A), if, according to a national authority, the old variety is still in cultivation or its denomination still of particular importance.

Appendix I(A)

Class

Class1: Avena, Hordeum, Seale, Triticale, Triticum
Class2: Panicum, Setaria
Class3: Sorghum, Zea
Class4: Agrostis, Alopecurus, Arrhenatherum, Bromus, Cynosurus, Dactylis, Festuca, Lolium, Phalaris, Phleum, Poa, Trisetum
Class5: Brassica oleracea
Class6: Brassica napus, B. campestris, B. rapa, B. juncea, B. nigra, Sinapis
Class7: Lotus, Medicago, Ornithopus, Onobrychis, Trifolium
Class8: Lupinus albus L., L. angustifolius L., L. luteus L.
Class9: Vacia faba L.
Class10: Beta vulgaris L. var. alba D.C., Beta vulgaris L. var. altissima
Class11: Beta vulgaris ssp. vulgaris var. conditiva Alef (syn.: Beta vulgaris L. var. rubra L.) , Beta vulgaris L. var. cicla L., Beta vulgaris L. ssp. vulgaris var. vulgaris
Class12: Lactuca, Valerianella, Cichorium
Class13: Cucumis sativus
Class14: Citrullus, Cucumis melo, Cucurbita
Class15: Anthriscus, Petroselinum
Class16: Daucus, Pastinaca
Class17: Anethum, Carum, Foeniculum
Class18: Bromeliaceae
Class19: Picea, Albiesm, Pseudotsuga, Pinus, Larix
Class20: Calluna, Erica
Class21: Solanum tuberosum L.
Class22: Nicotiana rustica L., N. tabacum L.
Class23: Helianthus tuberosus
Class24: Helianthus annuus
Class25: Orchidaceae
Class26: Epiphyllum, Rhipsalidopsis, Schlumbergera, Zygocactus
Class27: Proteaceae

CHAPTER 3

RATIONALES BEHIND THE INTRODUCTION OF PLANT VARIETY PROTECTION IN THAILAND

Introduction

Following the ratification of the World Trade Organisation Agreement (WTO) in 1994, the Thai government announced plans to introduce PVR protection, aiming to ensure compliance with the obligation under the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs)[1] The proposed legislation, to be enacted in the near future, has produced mixed reactions.[2]

This chapter examines whether the government's decision is correct. The investigation focuses on the TRIPs agreement. The breadth and scope of the WTO agreement inevitably means that some consideration must be given to its subsidiary

---

[1]For historical development of the TRIPs agreement, see, for example, Evan, G.E. "Intellectual Property as a Trade Issue: The Making of the Agreement on Trade-Related Aspects of Intellectual Property Rights" [1994] 18 World Competition Law and Review 137.
The reasons for intellectual property being included in the WTO agreement are primarily economic. There has been growing international pressure, particularly from the industrialised countries, for action to be taken to strengthen the protection and enforcement of intellectual property rights worldwide. The 1980s have witnessed a growth in losses suffered by industries in these countries through unauthorised use of intellectual property. ("GATT - the Intellectual Property Dimension" [1989] 1 Intellectual Property in Business 2 and Katzenberger, P. et al. "TRIPs and Intellectual Property"; in Beier, F-K, et al. (eds.) *From GATT to TRIPs - The Agreement on Trade-Related Aspects of Intellectual Property Rights,* Max Planck Institute for Foreign and International Patent, Copyright and Competition Law, Munich, 1996.)

[2]This issue is to be tackled in Chapters 6 and 7.

agreements and legal instruments, in particular the dispute settlement mechanism which is the cornerstone of the WTO agreement.[3]

---

[3]The lack of success of the previous GATT agreement shows the importance of a dispute settlement mechanism. The former dispute settlement lacks strength in a number of respects. One major drawback was that its negotiating approach was likely to result in more powerful countries dominating the process to the detriment of weaker countries and the integrity of GATT rules. The settlement could not oblige the party to the dispute to comply with any condemning decision by the GATT Council because of the requirement of consensus. The only remedy available to a country whose interests were damaged was retaliation; nevertheless, the threat of retaliation could be wielded successfully by countries with economic strength. Therefore, in the history of the GATT agreement, there were many cases where the panel reports were not implemented or implemented after long delays. (Pescatore, P. et al. *Handbook of WTO/GATT Dispute Settlement,* Vol. 1, Transnational Juris Publications, New York, 1995, p. 76 and Stubbs, R. et al (eds.), *Political Economy and the Changing Global Order,* MacMillan, London, 1994, p. 235.)
This is supported by a statistical profile in Hudec, R.E. "A Statistical Profile of GATT Dispute Settlement Cases", [1993] 2 Minnesota Journal of Global Trade 1.

3.1. Historical development of plant variety protection in Thailand

In 1990 plant variety protection was first proposed in Thailand during a seminar entitled "Plant Variety Protection" held by the Thai Plant Breeding Forum (a non-government organisation). The prime aim of the seminar was to persuade the government to introduce legal protection for plant varieties, as it was thought that this would encourage development in plant breeding in Thailand in order to keep pace with worldwide development. This attempt proved futile because the government did not believe that PVR protection would be beneficial to the country's economic development. Shortly before the enforcement of the Marrakesh Agreement Establishing the World Trade Organisation (WTO) in 1995, plant variety protection was proposed again for Thailand, in response to the TRIPs obligation on improving intellectual property regimes. At this time, the Thai Department of Intellectual Property, under political and economic pressure from the WTO agreement, announced plans to introduce a PVR system. To date, changes in government have meant that no legislation has been enacted.[4]

During 1990-1995, no action, particularly from seed companies, was taken to persuade the Thai government to change its decision. Whether this silence indicates that there is no need for PVR protection is open to question.[5]

---

[4]Since the announcement, Thailand has changed three governments and been facing an economic crisis. Such changes likely delay many projects proposed by a previous government. On 28th February 1997 the government of General Chavalit Yongjaiyuth issued an order for the appointment of a committee "Plant Variety Protection Bill Drafting". The draft is still on the parliamentary agenda legislation.

[5]This question is to be tackled in Chapter 6.

3.2. Thailand and the WTO-TRIPs agreement

The Thai government ratified the WTO agreement in 1994. Thailand must now ensure the country's compliance with a number of subsidiary agreements and associated legal instruments which are integral parts of this agreement (hereinafter referred to as "Multilateral Trade Agreements").[6] The TRIPs agreement requires member States to bring their intellectual property legislation and practices to required uniformity within a transitional period; and one of various forms of intellectual property protection is legal protection of plant varieties.

3.2.1. TRIPs - Plant Variety Protection in Thailand

The TRIPs agreement sets standards concerning the availability, scope and exploitation of intellectual property rights. These comprise copyright and related rights, trademarks, geographical indications, industrial designs, patents, layout-designs (topographies) of integrated circuits, protection of undisclosed

---

[6]Article II (2) of the WTO agreement provides that the agreements and associated legal instruments included in Annexes 1, 2 and 3 are integral parts of this Agreement, binding on all Members. The referred agreements are General Agreement on Tariffs and Trade 1994, Agreement on Agriculture, Agreement on the Application of Sanitary and Phytosanitary Measures, Agreement on Textiles and Clothing, Agreement on Technical Barriers to Trade, Agreement on Trade-Related Investment Measures, Agreement on Implementation of Article VI of the General Agreement on Tariffs and Trade 1994, Agreement on Implementation of Article VII of the General Agreement on Tariffs and Trade 1994, Agreement on Preshipment Inspection, Agreement on Rules of Origin, Agreement on Importing Procedures, Agreement on Subsidies and Countervailing Measures, Agreement on Safeguards, General Agreement on Trade in Services, Agreement on Trade-Related Aspects of Intellectual Property Rights, Understanding on Rules and Procedures Governing the Settlement of Disputes, Trade Policy Review Mechanism.

information, and control of anti-competitive practices in contractual licences.[7] Article 1 of the agreement provides that all member States are obliged to bring their intellectual property regimes up to the required standards; yet they are free to implement in their domestic laws more extensive protection than is required by the agreement.

In the field of patents, the agreement obliges the member States to provide patent protection for inventions in all fields of technology, provided that the inventions are new, involve an inventive step and are capable of industrial application. Nevertheless, member States may exclude from patentability inventions the commercial exploitation of which is contrary to public order or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by domestic law. The standard of public order or morality, protection involved (scope) and environmental harm will vary from country to country and will be a matter for local debate. The agreement also allows member States to exclude plants and certain other subject matter from patentability. However, the agreement obliges them to provide legal protection for plant varieties (hereinafter referred to as TRIPs plant variety protection) by means of one of the following: patents, an effective *sui generis* system which is widely referred to as PVR protection, or any combination thereof.[8,9] Member States may choose which of the three systems they prefer.

---

[7]See Appendix 3/1 for some main features of the TRIPs agreement.

[8]Plant variety protection under the TRIPs agreement was proposed by the European Community. (*Guidelines Proposed by the European Community for the Negotiations on Trade Related Aspects of Intellectual Property Rights*, GATT Doc. No. MTN.GNG/NG11/W/16 (28th November 1987))

Thailand is bound to provide "TRIPs plant variety protection" within a transitional period. In fact, it was before the WTO agreement came into effect that the Thai Ministry of Commerce prepared the draft of Plant Variety Protection Act (PVPA) which was based on the 1978 UPOV text. In its anxiety to respond to the WTO agreement, has the government rushed to draft legislation without giving serious consideration of its likely impact? Before deciding whether Thailand should introduce PVR legislation in the immediate future, it is necessary to examine whether the protection, even if it is politically justified, will benefit the country's

---

The United States, Japan, the Nordic countries and Switzerland, in their proposals, urged broad patent coverage without exclusions for plants and living organisms. (Article 23 of *Draft Agreement on the Trade-Related Aspects of Intellectual Property Rights, Communication from the United States,* GATT Doc. No. MTN.GNG/NG11/W/70 (11th May 1990); Article 4(3) of *Main Elements of a Legal Text for TRIPs, Communication from Japan,* GATT Doc. No. MTN.GNG/NG11/W/74 (15th May 1990); Article 1(1) of *Proposal by the Nordic Countries for the Negotiations on Standards and Principles for Trade-Related Aspects of Intellectual Property Rights,* GATT Doc. No. MTN.GNG/NG11/W/36 (10th July 1989); Article 229 of *Draft Amendment to the General Agreement on Tariffs and Trade on the Protection of Trade-Related Intellectual Property Rights, Communication from Switzerland,* GATT Doc. No. MTN.GNG/NG11/W/73 (14th May 1990))

The EC draft text and the draft text submitted by the developing countries, provided an exception for patents concerning plants and animals. (Article 23 of *Draft Agreement on Trade-Related Aspects of Intellectual Property, Communication from the European Community,* GATT Doc. No. MTN.GNG/NG11/W/68 (29th March 1990); Article 4(1)(ii) of *Communication from Argentina, Brazil, Chile, China, Columbia, Cuba, Egypt, India, Nigeria, Peru, Tanzania and Uruguay,* GATT Doc. No. MTN.GNG/NG/11/W/71 (14th May 1990)).

Whether plant varieties should be protected, and if so, by patents or otherwise had not been dissolved until 7th December 1990 (Ministerial meeting in Brussels). (Stewart, T.P. (ed.). *The GATT Uruguay Round: A Negotiating History (1986-1992),* Vol. II: Commentary, Kluwer, Deventer, The Netherlands, 1993, p. 2267)

[9]These three options of TRIPs plant variety protection are to be discussed in the following chapter.

economy.[10] On the assumption that there is no economic justification at this stage for PVR legislation (as will be argued in this thesis), what can Thailand do?[11] Three possible solutions are: (1) to delay the introduction of the protection, (2) not to provide the protection at all, or (3) to introduce the protection but limit the effects of the system.

3.2.1.1. Delaying the application of the provision

Throughout the TRIPs negotiations, the provision of transitional arrangements was a part of the TRIPs agenda;[12] and it was agreed that developing country member States might encounter problems in the preparation and implementation of intellectual property laws, and that economic dislocation would ensue from such

---

[10]This investigation is to be carried out in Chapter 6.

[11]Whether, and, if so, when, Plant Variety Protection Act should be introduced in Thailand for its most economically desirable benefit has never been examined. Even though in debates organised by the government, a number of representatives from seed companies reacted favourably to the introduction of the Act, no study has been carried out to support their views or no serious problem of piratical activities in the seed market has been reported. Therefore, no solid evidence can be found to suggest that Thailand has to introduce Plant Variety Protection Act now or before the given transitional period.

[12]The US pharmaceutical manufacturers and intellectual property groups criticised Articles 65 and 66 of the draft of the TRIPs agreement (transitional arrangements) on the ground that the transitional periods for developing and least-developed countries were too long.
(See Smith, E.R., Exec. Dir. and Gen. Councel, Int'l. Intell. Prop. Alliance, *Testimony before U.S. House of Representatives Committee on Ways and Means, Subcommittee on Trade,* (23rd January 1992), at 4 and Richardson, P.C., Senior Asst. Gen. Councel and Gen. Patent Councel, Pfizer Inc., Representing the Intellectual Property Committee, *Testimony before U.S. House of Representatives Committee on Ways and Means, Subcommittee on Trade,* (23rd January 1992), at 2; cited in Stewart, T.P. (ed.), *The GATT Uruguay Round: A Negotiating History (1986-1992),* Vol. II: Commentary, Kluwer, Deventer, Netherlands, 1993, p. 2285)

laws.[13] Article 65 of the TRIPs agreement provides that member States may delay applying the provisions of the agreement for different periods of time: 1 year, 5 years, and 10 years.

Thailand, as a developing country, is entitled to delay the application of the provisions of the agreement for a period of 5 years. This delay is allowed by Paragraphs (1) and (2) of Article 65 which can be read that no member State is obliged to apply the Provisions of the TRIPs agreement before the period of 1 year following the enforcement date of the WTO agreement (January 1995) and any developing country is entitled to delay for a further period of 4 years the date of application. In the case that a developing country member State is obliged to extend product patent protection to areas of technology where such protection is not given in its territory on the general date of the application of this Agreement, Paragraph 4 of Article 65 provides that such a member State may delay the application of the provisions on product patents for an additional period of 5 years. Thus, a developing country which is a WTO member State may delay the application of the WTO agreement on product patent protection up to the period of 10 years.

---

[13]A transitional arrangements provision is a common section found in most new laws. It is designed to provide a society or sectors involved time to adjust themselves to any change which may result from a new regime.

3.2.1.1.1. Immediate problems concerning the introduction of PVR protection

Problems that Thailand is likely to encounter if PVR protection is introduced now include: inadequate infrastructure to implement the proposed law, political conflict, and economic dislocation.

3.2.1.1.1.1. Inadequate infrastructure and a political conflict

All forms of intellectual property protection are an economic and social cost to society; investment has to be made on infrastructures, e.g. buildings, staff, machines, etc. Such cost varies within the different form of intellectual property; a patent system provides a very expensive form of protection whereas copyright is a far cheaper form.[14]

As revealed in Chapter 2, the implementation of a PVR system, particularly a system with a so-called DUS[15] technical examination, is costly and complicated; it requires a wide range of administrative, legal and technical infrastructures. This leads to two main questions: does the government of Thailand have the required infrastructure, and which government office should run the system?[16] The

---

[14]For example, in 1995, within the UK Patent Office, 416 employees deal with patents, 238 with trade marks, 26 with designs.

[15]Distinctness, uniformity and stability.

[16]A similar question has been addressed in the report "Legal Protection of Plants in Australia under Patent and Plant Variety Rights Legislation" (Byrne, N. *Legal Protection of Plants in Australia under Patent and Plant Variety Rights Legislation,* Australian Patent Office, Australian Plant Variety Rights Office, 7th November 1990). The report raised the question where the plant variety rights office should be located. It was suggested: "... the two offices (the Patent Office and

Department of Intellectual Property (DIP) and the Department of Agriculture (DOA) have been drafting two separate Plant Variety Protection Acts. In essence, both drafts are similar; but the DIP's proposed Act is relatively well-drafted because of its long-established experience in intellectual property laws. Both departments have shortcomings: the DIP lacks technical skill and infrastructure whereas the DOA lacks legal skill. Therefore, if the country decides to adopt a PVR system which requires a growing test, each department on its own will be ill-equipped to operate the system.

It is unlikely that these departments, which have conflicting interests, will cooperate to draft the Act and implement the system. The DIP regards itself as the main government body established to administer an intellectual property regime whereas the DOA takes the view that as PVR systems in most countries are administered by Ministries of Agriculture or similar authorities, it should administer a PVR system in Thailand when the system is established. Each department wants to be appointed to administer the Act. Effective cooperation to create a system which gains respect in all quarters would doubtless enhance both sides' standing at the international level and popularity in the country. Conversely both sides stand to lose from a system which attracts opprobrium from users and commentators. It is likely that power, credit and possibly the political benefit gained from the introduction and implementation of the Act are the main

---

the PVR Office) should be encouraged to cooperate to a far greater extent than they appear to do at the present... The resources and experience of the Patent Office are far and greater than the PVR Office. In appropriate circumstances and under mutually satisfactory terms, the Patent Office could assist the PVR Office with, for example, policy development or legislation." The report proposed certain recommendations; one of which is: "A study should be undertaken to determine whether it would desirable or practicable to integrate the activities of the PVR Office with the Patent Office, in a Single Intellectual Property Rights Office."

motivating factors rather than the country's economic and technological well-being.[17]

The TRIPs agreement anticipates that developing countries may lack the necessary infrastructure and has allowed for that. For example, member States can defray the costs by charging fees, provided that such charges are consistent with the "reasonable procedures and formalities" clause under Article 62 of the agreement. Member States may receive technical assistance for this purpose under the TRIPs agreement itself.[18]

3.2.1.1.1.2. Economic dislocation

The introduction and effective enforcement of new laws or rules may bring many changes in a society,[19] in the case of intellectual property laws by making illegal

---

[17]Recommendations to overcome this problem are to be addressed in Chapter 8.

[18]Article 67 of the Agreement provides that in order to facilitate the implementation of this Agreement, developed country member States shall provide, on request and on mutually agreed terms and conditions, technical and financial cooperation in favour of developing and least-developed country member States. Such cooperation shall include assistance in the preparation of domestic legislation on the protection and enforcement of intellectual property rights as well as on the prevention of their abuse, and shall include support regarding the establishment or reinforcement of domestic offices and agencies relevant to these matters, including the training of personnel.

[19]For instance, the revision of Japan's copyright law causes on-line karaoke companies in Japan to consider moving to Hawaii to take advantage of favourable US usage fees for music transmissions over the Internet. The new law extends protection to transmission and storage of copyrighted materials on network servers, including music which is part of on-line karaoke transmission. Japanese music licensing groups charge fees as high as 20 per cent of the revenue generated from music database, such as those used by the on-line karaoke companies. By

the unauthorised use or exploitation of things or information. Delay in the form of a transitional period will allow the society to adjust itself to the impending new order.

Intellectual property rights are exclusive; they may be exercised to prevent others encroaching upon the protected matter. For instance, intellectual property may be used against counterfeiters and, in certain circumstances, copyists and misappropriators. Counterfeiting is by no means a new phenomenon,[20] but has been growing steadily, assisted by rapid developments in technology, and affecting every sector of trade. Some developing countries have taken the lenient view towards counterfeiting because it appeared to offer a shortcut to economic prosperity; copying others' ideas is a cheap and short process. The economic success of Japan after the Second World War (the late 1950s)[21] and Taiwan in the

---

contrast, US fees are generally 2 per cent of revenue. ("Copyright Law May Drive Japanese On-line Companies Overseas" [September 1997] 9 Journal of Proprietary Rights 22.)

[20]The counterfeiters of the late twentieth century are heirs to a long tradition. Throughout human history, imitation has followed close on the heels of creation. By the biblical version, even mankind owes its existence to the copying of the divine image. Most of the ancestors of modern counterfeiters indulged in faking artistic objects, rather than industrial ones. There were not that many distinctive luxury product lines to copy in ancient Rome or mass-market items to imitate in the Middle Ages. Artistic faking and deception stretches back at least to the fifth century BC. (Fenby, J. *Piracy and the Public: Forgery, Theft and Exploitation,* Frederick Muller, London, 1983, p. 13.)

[21]Momberg considers copying of intellectual property as the basic means of technology transfer. He states: "It is likely that most significant historical development since World War Two is the emergence of Japan as the world's premier industrial (as presently distinct from economic) power. In essence this development is an intellectual property tale, for Japan achieved this position by brilliantly imitating and refining technology and marketing techniques acquired from the West. In the result there has been a monumental transfer of the means of real production from the West to Japan (and increasingly other Far East nations affected by Japan's example)."

late 1970s are examples of the benefit resulting from the free access to and the use of others' ideas.[22]

Unauthorised use of intellectual property has generated economic activity in many developing countries.[23] Many counterfeiting industries, such as fake watch-making and leather industries, have been established in Thailand and create jobs and income for Thais.[24] There are no statistical data of income gained from these activities; but the estimates of economic loss of imported goods may roughly indicate the amount gained.[25]

(Momberg, D. et al. *Strategy in the Use of Intellectual Property: A Guide to Managing Business' Most Valuable Asset,* Gerundive Press, Hong Kong, 1986, p. 12.)

[22]The Circuit Judge of the Court of Appeals in *Smith* v *Chanel Inc.*, 402 F 2d 562 (1968) at 567 said: "A related consideration is also pertinent to the present case. Since appellees' perfume was unpatented, appellants had a right to copy it, as appellees concede. There was a strong public interest in their doing so, "[f]or imitation is the life blood of competition. It is the unimpeded availability of substantially equivalent units that permits the normal operation of supply and demand to yield the fair price society must pay for a given commodity".

[23]See Prima Braga, C.A. "The Economics of Intellectual Property Rights and the GATT: A View from the South" 22 [1989] Vanderbilt Journal of Transnational Law 244 where he argues that the political economy of intellectual property protection helps to explain the resistance of many developing countries to reforms even when a strong case, based on economic self-interest, can be developed.

[24]It has been well known amongst tourists who visit Thailand that the quality of Thai counterfeit products is quite good and their prices are very cheap; with some designer products, e.g., handbags, purchasers may find it difficult to differentiate between fake and authentic products. The demand for these counterfeit products from foreign tourists and markets has never been decreasing.

[25]For example, in 1996 loss of royalties in music, video and software industries in Thailand amounts to $ 400 million. ("Thailand and the Philippines Promise Piracy Crackdowns" [July 1997] 9 Journal of Proprietary Rights 24.)

Even though Thailand has a reputation as the world's leading piracy centre, not all lines of business are affected by the piracy;[26] amongst those unaffected is the seed industry. According to the DOA, there has never been any complaint from seed companies about serious economic loss from unauthorised propagation of proprietary varieties, probably because it is not of sufficient economic importance.[27]

3.2.1.1.2. The TRIPs transitional arrangements[28]

How long can Thailand delay the enactment of PVR legislation? It is understood amongst Thai politicians and government officials that Thailand can delay making provision for legal protection of plant varieties for a period of up to 5 years.[29] Verma takes the view that since most developing countries are currently not protecting plant varieties, they will have a 10-year transitional period.[30] The

---

[26]The Thai Ministry of Justice reports that unauthorised use of intellectual property in Thailand concentrates on copyright and trademark, as suggested by the record of intellectual property litigation.

[27]A letter from Dr. Puntakhul Juntanamunta, the Director of Plant Propagation Centre 4, Department of Agriculture, Thailand, dated 19 October 1995. Also see Chapter 6 for more details.

[28]See Appendix 3/2 "Main dates in the application of the TRIPs agreement"

[29]Mr. Jurin Laksanavisit, the Deputy Commerce Minister, gave an interview in the newspaper "Bangkok Post" in 8th October 1994: "... the Government now has an offensive strategy toward the protection of intellectual property right. The strategy does not allow for last-minute moves to make the country comply with international standards. Thailand has been granted a transitional period of five years to issue new laws to protect intellectual property rights. However, Thailand will not need that much time. The three new laws - Sub-Patent Law, Plant Variety Protection Law and Geographical Origin Protection Law - will come on line soon."

[30]Verma, S.K. "TRIPs and Plant Variety Protection in Developing Countries" [1995] 6 European Intellectual Property Review 281.

question turns however on whether[31] PVR to be conferred by the proposed Act is a product patent for the purposes of the agreement[32] The nature of PVR regimes in many countries suggests that PVR protection may be viewed as the derivative of patent protection. In other words, a PVR system provides a patent-like right, an exclusive right to prevent others from misappropriating a breeder's protected variety.[33] However, it may be argued that PVR should not be regarded as a product patent because in general patents and PVR are subject to separate legislative regimes.[34] From accessible documentary evidence concerning the TRIPs

---

[31]It may be questionable whether 5-year and 10-year transitional periods result in considerable difference in economic impact. The longer transitional period offers better flexibility; the TRIPs plant variety protection may be introduced to Thailand before the expiry of 10-year period, provided that the protection is economically beneficial (or least prejudicial).

[32]As discussed earlier, developing country Members may delay the application of the agreement, provided that they are obliged to extend product patent protection to areas of technology not so protectable in their territories.

[33]See, for example, *Public Varieties of Mississippi Inc* v. *Sun Valley Seed Co* 14 USPQ2d 2055 where the District Court of N.D. Mississippi took the view:

"[I]n effect, then, the PVPA awards the equivalent of patent protection to sexually reproduced plants which meet the Act's certification requirements... Because of the similarity in purpose and construction between the PVPA and the patent laws, cases construing the patent statutes supply compelling analogies to aid the court in interpreting the PVPA."

[34]Nevertheless, on many occasions the definition of terms in a PVR regime has been used to assist the interpretation of terms in patent law. In *Hybrid plants/ LUBRIZOL* ([1990] 3 Official Journal of the European Patent Office 71), the Technical Board of Appeal examined the question of 'plant varieties.' The Board analysed the concept of 'plant varieties' in Article 53(b) EPC in the light of the corresponding provisions in the UPOV Convention.

Also see *PLANT GENETIC SYSTEMS/ Glutamine synthetase inhibitors* [1995] European Patent Office Report 357. The Technical Board of Appeal took the view: "Thus, in the Board's judgement, the concept of 'plant varieties'..., refers to any plant grouping within a single botanical taxon of the lowest-known rank which, irrespective of whether it would be eligible for protection under the UPOV Convention, ..."

agreement,[35] whether or not PVR is a product patent for the purposes of Article 65 appears never to have been discussed.[36] The adoption of interpretations of the TRIPs agreement is under the authority of the Ministerial Conference and the General Council on the basis of a recommendation by the TRIPs Council, and so the interpretation process is quite lengthy. Furthermore, the rationale behind the transitional arrangements is to allow developing and least-developed counties a period within which to adjust and prepare domestic legislation on the protection and enforcement of intellectual property rights. Therefore, vagueness on the issue of transitional arrangements combined with the overall aim of the arrangements, may allow a developing country (where a PVR system has never been introduced) a 10-year transitional period.

Thailand might also delay the introduction of PVR protection on the basis that Article IX (3) of the WTO agreement allows (in exceptional circumstances) the Ministerial Conference (including the General Council) to waive an obligation imposed on a member State by this Agreement or any of the Multilateral Trade Agreements (including the TRIPs agreement).[37] However, a waiver is temporary; any waiver of more than one year has to be reviewed by the Ministerial Conference annually until the waiver terminates. A request for a waiver must be submitted to the TRIPs Council and the Council must report on it to the Ministerial Conference. A decision to grant a waiver in respect of any obligation subject to a transitional period or a period for staged implementation that the requesting member State has

---

[35]See Appendix 3/3 "Communications with the World Trade Organisation".

[36]However, the inclusion of legal protection for plant varieties in Section 5 "Patents" of the TRIPs agreement may suggest that the agreement regards PVRs as part of patents.

[37]"Exceptional circumstances" is not defined; therefore, it depends on the justification of the circumstances by the Ministerial Conference. The justification will be decided case by case.

not performed by the end of the relevant period has to be taken only by consensus. Because of the inconvenience resulting from the requirements of this provision (e.g., whether the reason for the delay of the introduction of PVPA will be justified as "exceptional circumstances", the annual review of the waiver and a short period of waiver), it may not be prudent immediately to apply for waiver.

Vagueness in the transitional arrangements allows the Thai government to assume that it can delay implementation of PVR legislation for up to 10 years.[38]

3.2.1.2. TRIPs infringement

Even if PVR protection is economically undesirable, it is questionable whether Thailand should introduce the proposed Act. What is the legal or political consequence of the failure to provide TRIPs plant variety protection?

3.2.1.2.1. Legal and political consequences

In the case of any dispute concerning the enforcement of the TRIPs agreement, the agreement itself provides that the dispute settlement is subject to the provisions of Articles XXII and XXIII of the GATT agreement 1947 as elaborated and applied by the Understanding on Rules and Procedures Governing the Settlement of

---

[38]Applying a "contra proferemtem" rule of construction (against the party putting forward), interpretation of a document in case of ambiguity against the party who drafted it or whose document it is. (Burke, J. (ed.) *Jowitt's Dictionary of English Law*, Vol. 1, Sweet & Maxwell, London, 1977.)

Disputes (DSU).[39] The Uruguay Round DSU strengthens the existing system in many respects. The new dispute settlement system is a judicial approach, i.e., if the losing party fails to implement recommendations made by a Dispute Settlement Body, retaliatory action by the prevailing party will be authorised automatically.[40]

Does failure to provide TRIPs plant variety protection constitute a TRIPs dispute? Article 64 which deals with TRIPs dispute settlement does not define the scope of a TRIPs dispute. Because the TRIPs dispute settlement is subject to GATT and DSU, the GATT settlement procedure may cast light on the scope of a TRIPs dispute. Article XXIII (a) allows a member State to establish a dispute case if any benefit accruing to it directly or indirectly under the GATT agreement is being nullified or impaired or the attainment of any objective of this Agreement is being impeded as the result of the failure of another member State to carry out its obligations under this Agreement.[41] This provision is repeated in Article 3 (8) of

---

[39]Article XXII provides for consultation in case a contracting party considers the Agreement is not operating properly for its benefit. Article XXIII allows any party which has not obtained a satisfactory adjustment of its interests to bring the matter before the contracting parties.

[40]The aim of the WTO dispute settlement system is to secure a positive solution to a dispute. Therefore, consultations between the member States concerned is preferable. If the consultations fail and both parties agree, the dispute case may be brought to the WTO Director-General. In the case that the member State concerned does not respond to a request for consultations within 10 days or if the consultations fail to arrive at a solution after 60 days, the complainant can ask the Dispute Settlement Body to establish a panel to examine the case. ("Consultations: the First Stage in Settlement of Disputes" [1995] 3 Focus 2, at 2.)

See Appendix 3/4 "The structure of the dispute settlement mechanisms".

[41]The 1962 Panel Report on 'Uruguayan Resource to Article XXIII' notes:

"... In cases where there is a clear infringement of the provisions of the General Agreement, or in other words, where measures are applied in conflict with the provisions of GATT and are not permitted under the terms of the relevant protocol under which the GATT is applied by the contracting party, the action would, *prima facie*, constitute a case of nullification or impairment

the DSU which provides that an infringement of the obligations assumed under a covered agreement (including the TRIPs agreement) is considered *prima facie* to constitute a case of nullification or impairment. This may allow another member State to bring a case against Thailand under the dispute settlement mechanism.[42]

---

and would *ipso facto* require consideration of whether the circumstances are serious enough to justify the authorisation of suspension of concessions or obligations"

The Agreed Description of the Customary Practice of the GATT in the Field of Dispute Settlement annexed to the 1979 Understanding Regarding Notification, Consultation, Dispute Settlement and Surveillance provides:

"... A *prima facie* case of nullification or impairment would *ipso facto* require consideration of whether the circumstances are serious enough to justify the authorisation of suspension of concessions or obligations, if the contracting party bringing the complaint so requests. This means that there is normally a presumption that a breach of the rules has an adverse impact on other contracting parties, and in such cases, it is up to the contracting parties against whom the complaint has been brought to rebut the charge. (L/1923, adopted on 16th November 1962, 11S/95, 99-100, para. 15 and 26S/216, para. 5; cited in Porges, A. et al. *GATT, Analytical Index: Guide to GATT Law and Practice,* 6th ed., Geneva, 1994, p. 608)

[42]What might induce a member State to bring such a case? Under Articles XXII and XXIII as well as the DSU, the dispute settlement mechanism allows any member State to bring a dispute case. In the history of GATT dispute settlement, all dispute cases involved considerable economic conflict between parties concerned. In the case of a TRIPs infringement concerning the obligation of plant variety protection, it is questionable that any member State would want to raise a dispute case against Thailand because of its relatively insignificant economic importance (compare to other sectors under other agreements, such as textile products and agricultural products). Compared to past litigation regarding the absence of patent protection for pharmaceuticals in Thailand, the resulting economic losses were sufficient enough for the U.S. Pharmaceutical Manufacturers' Association (PMA) to push the U.S. government to take action against Thailand. In early January 1991 the PMA was threatening to file a petition against the Thai government with the office of the U.S. Trade Representative (USTR). (See, for example, [January 1988] IP Asia 17; [October 1989] IP Asia 4; [February 1991] IP Asia 21; *Bangkok Post*, 27th November 1987; *Bangkok Post* 13th December 1990; *Bangkok Post*, 12th January 1991; *Bangkok Post*, 14th January 1991; *The Nation*, 11th January 1991; and *The Nation*, 12th January 1991)

Since the enforcement of the WTO agreement, the US government has initiated WTO dispute settlement proceedings against many countries on the grounds of alleged breaches of their

The dispute settlement mechanism is administered by the Dispute Settlement Body (DSB). The DSB has the authority to establish panels, adopt panel and Appellate Body reports, maintain surveillance of implementation of rulings and recommendations, and authorise suspension of concessions and other obligations under the covered agreements. A panel is an important body in the dispute settlement process. Once a panel is established and its terms of reference are defined, each party to the dispute has to deposit its written submissions with the WTO Secretariat for immediate transmission to the panel and to the other party or parties to the dispute. If two parties cannot develop a mutually satisfactory solution, the panel must submit its report which sets out the findings of fact, the applicability of relevant provisions and the basic rationale behind any findings and recommendations. This report has to be adopted at a DSB meeting unless one of the parties to the dispute formally notifies the DSB of its decision to appeal or the DSB decides by consensus not to adopt the panel report. An appeal can be made to a standing Appellate Body (AB). An appellate report must be adopted by the

---

obligations under the TRIPs agreement. It is reported in July 1997 that the US Trade Representative (USTR) has initiated WTO dispute settlement proceedings against Ecuador, Ireland, Denmark and Sweden and threatened to initiate the proceedings against Greece and Luxembourg unless intellectual property violations decrease. The proceedings have been pending against Turkey, Indonesia and India. ("USTR Release Special 301 Lists and Initiates WTO Proceedings" [July 1997] 9 Journal of Proprietary Rights 23) Three months later, a WTO dispute settlement panel released an interim report criticising India for its failure to amend its patent law. The report lays the foundation for the US to impose retaliatory trade measures against India. ("India Loses Ground in Patent Dispute with US" [September 1997] Journal of Proprietary Rights 20.) Yet, the proceedings have been instituted mainly in the area where economic loss from inadequate intellectual property protection is substantial. For instance, the US government brought the case against India based on charges that its pharmaceutical and chemical industries have sustained substantial damages because India does not protect their patents.

DSB and unconditionally accepted by the parties to the dispute unless the DSB decides by consensus not to adopt the appellate report. Once the report has been adopted by the DSB, the member State concerned has to implement the recommendations and rulings of the DSB within a reasonable period. If the recommendations and rulings are not implemented within such a period, Article 22 of the DSU provides that the complainant may seek further redress which includes compensation, the suspension of concessions or other obligations.

In which circumstances can the DSU authorise the suspension of concessions or obligations? Article 22 (1) provides that such a suspension may be authorised if the recommendations and rulings of the DSB are not implemented within a reasonable period of time. The suspension of concessions or obligations may be granted to not only the same sector(s) as that in which the panel or Appellate Body has found a violation or other nullification or impairment, but also other sectors under the same agreement.[43] Furthermore, a complainant may seek to suspend concessions or other obligations under another covered agreement.[44] If the complainant decides to

---

[43]For the purposes of this provision, "sector" means:

(i) with respect to goods, all goods;

(ii) with respect to services, a principal sector as identified in the current "Services Sectoral Classification List" which identifies such sectors;

(iii) with respect to trade-related intellectual property rights, each of the categories of intellectual property rights covered in Section 1, or Section 2, or Section 3, or Section 4, or Section 5, or Section 6, or Section 7 of Part II, or the obligations under Part III, or Part IV of the Agreement on TRIPs.

[44]The covered agreements are: Agreements on trade in goods (which include General Agreement on Tariffs and Trade 1994, Uruguay Round Protocol GATT 1994, Agreement on Agriculture, Agreement on Sanitary and Phytosanitary Measures, Agreement on Textiles and Clothing, Agreement on Technical Barriers to Trade, Agreement on Trade-Related Investment Measures, Agreement on Implementation of Article VI, Agreement on Implementation of Article VII, Agreement on Preshipment Inspection, Agreement on Rules of Origin, Agreement on Import

seek authority for retaliation in other sectors or under other covered agreements, it must submit its request, including its rationale, to the DSB and the relevant Councils.[45] Possible trade sanctions imposed for a TRIPs violation, or so-called "cross retaliation", are a very important feature because they strengthen the power of the complainant. In other words, suspension of concessions or obligations in the TRIPs agreement itself is not seen as a practicable or effective measure to persuade a member State to implement the recommendations.[46] It may be seen that the DSU provides broad remedies.[47,48]

Licensing Procedures, Agreement on Subsidies and Countervailing Measures, and Agreement on Safeguard), General Agreement on Trade in Services, the TRIPs agreement, the DSU, Agreement on Trade in Civil Aircraft, Agreement on Government Procurement, International Dairy Arrangement, and Arrangement Regarding Bovine Meat. The applicability of the DSU to last four Agreements shall be subject to the adoption of a decision by the Signatories of each Agreement.

[45]See *Draft Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations*, GATT Doc. No. MTN.TNC/W/FA (20th December 1991) at T.6.

[46]If an effective remedy cannot be had under the TRIPs agreement, it may be available under one or other of the covered agreements (in footnote 44). However, suspension of concessions or obligations cannot be issued if a covered agreement prohibits such suspension.

[47]Footer suggests: "... under the DSU the available remedies extend not just to compensation but to the possibility of retaliation, in the form of suspension of concessions under the 'covered agreements'. In fact Article 22 of the DSU opens the way not only for retaliation but also for cross-retaliation under the 'covered agreements'..." (Footer, M. *TRIPs and the EC*, CLIP Seminar Report, Intellectual Property Institute, London, 1995, p. 20.)

[48]However, the authorisation of the suspension of concessions or obligations is not a simple process; it requires a number of considerations, especially in other sectors under the same agreement and under another covered agreement. For example, a violation or other nullification or impairment must be found; however, Article 3(8) of the DSU makes it clear that an infringement of the obligations assumed under a covered agreement is considered *prima facie* to constitute a case of nullification or impairment. In order to seek to suspend concessions or obligations in other sectors under the same agreement and under another covered agreement (so-called cross retaliation), a complainant has to show that it is not practicable or effective to

3.2.1.2.2. Economic consequences of TRIPs infringement

As discussed above, a TRIPs infringement may enable the complainant to take one or more of appropriate measures. These include claims for compensation and the suspension of concessions or other obligations. Suspension of concessions and cross-retaliation are the main economic pressures on the Thai government to ensure compliance with TRIPs obligations. What is the economic impact resulting from this retaliation?

The WTO ratification is believed to have a positive impact on exports and investment in Thailand. The WTO secretariat has released statistical data suggesting that the trade liberalisation under the WTO agreement will add between $109 billion and $510 billion to world income over the next 10 years (the year 2005). Economists have projected that the trade liberalisation would increase world trade volumes between 9 to 20 per cent. The boost to world incomes will work through to some extent into the export-oriented Thai economy. The Thai Office of Agricultural Economics suggests that the agreement will encourage rice production in Thailand to increase by 11.12 per cent, adding 0.22 per cent to the GDP. This corresponds to the US Department of Agriculture's estimates of how the WTO agreement will affect world rice trading.

---

suspend concessions or obligations in the same sectors and other sectors under the same agreement respectively. The DSU does not define the term "practicable and effective". Whether or not the suspension of concessions or obligations concerning TRIPs plant variety protection is practicable or effective will be decided by the DSB.

The country anticipates that the WTO agreement will give it increased access to foreign markets. Thailand's economic development heavily relies on exports. Expansion of foreign markets is always a high priority in every National Economic and Social Development Plan.[49] A number of attempts have been made to improve the access to foreign markets, including bilateral agreements and the organisation of trade fairs. The WTO concessions will benefit Thailand's economic development.

Table 3.1 Concessions concerning the export of industrial products

Countries	Tariff reduction by major Thailand's trading countries (%)	Tariff reduction by Thailand (%)
The US.	29.0	20.3
European Community	21.4	24.8
Japan	50.0	17.8
Canada	36.5	11.7
Australia	40.2	24.7
South Korea	62.7	23.1
Switzerland	35.3	25.8
Sweden	26.4	34.9
Norway	46.2	7.2
Finland	31.1	-4.6

[49]For example, the Seventh National Economic and Social Development Plan (1992-1996) provides that in order to encourage well-balanced development, certain opportunities and constraints need to be taken into consideration. Amongst the developmental opportunities is export expansion. Main targeted markets are the European Community and the North American Free Trade Area (NAFTA) which includes the US, Canada and Mexico.

Table 3.2 Foreseeable benefit from the WTO agreement to Thai agricultural exports[50]

Product	Market
Rice	-Japanese market will increase from 379,000 tones in 1998 to 758,000 tones in 2002 (tariff will decrease to 0 per cent). -Korean market will increase from 51,307 tones in 1998 to 205,228 tones in 2002 (tariff will decrease to 5 per cent).
Cassava	Korean market in 1998 -Volume of imported tapioca pellet will be 1 million tones and tariff will be 3 per cent. -Volume of imported tapioca starch will be 2,400 tones and tariff will be 9 per cent.
Canned pineapple	-European market: tariff will decrease from 32-33 per cent to 26-18 per cent. -US market: tariff will decrease from $ 0.55 per kilo to $0.35 per kilo. -Japanese market: tariff will decrease from 73-40 per cent to 47-26 per cent.
Orchid	-European market: tariff will decrease from 24-17 per cent to 12-9 per cent. -US market: tariff will decrease from 8 per cent to 6 per cent.
Oil palm	-European market: tariff will decrease from 20-4 per cent to 12.8-0 per cent. -US market: tariff will decrease from $ 0.11 per kilo to 0 per cent. -Japanese market: tariff will decrease from 7-5 per cent to 3.5-2.5 per cent.

Concessions under the Agreement of Textiles and Clothing are another benefit from the WTO agreement. These commodities are important Thai exports. The main obstacle to increased exports are quota systems in Thailand's major trading partners, particularly the US and EC. As a result of quotas, the export of textile and clothing products to these countries is limited to only 44 per cent of total production. The US and Europe are targeted because of substantial markets and high purchasing power of consumers. The WTO agreement requires all quantitative restrictions to be eliminated within 10 years of the establishment of WTO.

---

[50]This economic ambition may need to be revised in the light of the economic upheavals in Thailand.

The Thai government believes that concession suspension will damage the country's economy. The current status of Thailand's economy indicates strong need for exports.[51] The country knows only too well the economic hardship that flows from trade sanctions. In the past, the US government imposed unilateral trade sanctions, following concerns in Congress about the country's trade losses via infringement and inadequate intellectual property protection in Thailand. This led to the passage of the so-called Special Section 301 provision in the US Omnibus Trade and Competitiveness Act of 1988.)[52,53] Under this section, Thailand was placed in the US "Priority Foreign Country" category. The US government, therefore, revoked tax concessions under the Generalised System of Preference (GSP) on 16 export items worth $860 million.[54] By means of Section 301, the US

---

[51]See Chapter 5 for more details.

[52]Slaughter, J. "TRIPs: the GATT Intellectual Property Negotiations Approach their Conclusion" [1990] 11 European Intellectual Property Review 418, at 419.

[53]Counterfeiting and copying of intellectual property products have caused developed countries enormous economic loss. This problem seems to be growing despite the attempt by certain developed countries, in particular the US, to strengthen intellectual property regimes in various developing countries where their products are marketed. In 1994 sound recording pirate sales reported from 62 countries had a retail value of $2.25 billion (compared to the corresponding figure in 1993 which was $1.96 billion) (IFPI, *Pirate Sales,* May 1995) It has been estimated that during 1986, product imitation in countries without patent protection (or with inadequate protection) cost American industries about $61 billion; the economic loss was particularly high in the pharmaceutical industry. (Stamm, O.A. "GATT Negotiations for the Protection of New Technologies" [1991] 73 Journal of the Patent & Trademark Office Society 680, at 692.)

[54]Under the GSP, developed countries accord a reduction of or exemption from custom duties on qualifying imports from designated developing countries; imports from other countries to be taxed at general rates. The GSP has played an important role in contributing to freer market access and to trade expansion. Since the establishment of the GSP in the early 1970s, tariff preferences under the GSP have been contributing to economic development in the Third World by facilitating trade expansion through more open access to the markets of developed countries. It was reported that during 1976-1980, imports from developing countries benefiting from GSP

government is able to use the size of its market as both an incentive to negotiate and a weapon when negotiations fail to achieve the desired goal.[55] The integration of the issue of intellectual property in trade fora will strengthen the negotiating power of developed countries to force developing countries to improve the protection.

From what has been said about main consequences of a TRIPs infringement, Thailand ought not to risk WTO economic retaliation even if the likelihood of TRIPs infringement is weak. Furthermore, the Thai government has long adopted the admirable foreign affairs policy of complying with all international agreements which the country has ratified.

2.3. Undermining a PVR system

A law means little if access to it or its enforcement is not effective; and a law may be undermined by, for example, weak enforcement and discriminatory enforcement. The history of the Thai intellectual property protection, particularly copyright and patents is a good example of bad practice. Weak enforcement of intellectual property laws has prevailed and has been criticised by many developed countries; nonetheless, it may secretly be viewed by the Thai government as a measure to facilitate economic development in the field of intellectual property. The discriminatory enforcement of the Japanese Prohibition of Private Monopoly

---

treatment grew at an average rate of nearly 27 per cent annually. (Organisation for Economic Cooperation and Development, *The Generalised System of Preference: Review of the First Decade*, Paris, 1983.)

[55]Evan, G.E. "Intellectual Property as a Trade Issue: The Making of the Agreement on Trade-Related Aspects of Intellectual Property Rights" [1994] 18 World Competition Law and Economics Review 137, at 152.

and Maintenance of Fair Trade Act 1947 is another example of undermining practice. After the Second World War, the US introduced competition law as part of the new economic order to Japan; the law was enacted but undermined.[56]

Can and should Thailand follow a similar path? The TRIPs agreement expressly bans the discriminatory enforcement of intellectual property protection. Article 3(1) of the agreement expresses that each member State shall accord to the nationals of other member States treatment no less favourable than that it accords to its own nationals with regard to the protection of intellectual property. However, paragraph 2 of the Article provides that member States may avail themselves of the exceptions permitted under paragraph 1 above in relation to judicial and administrative procedures only where such exceptions are necessary to secure compliance with laws and regulations which are not inconsistent with the provisions of this agreement and where such practices are not applied in a manner which would constitute a disguised trade restriction. What exception relevant to the topic under discussion is permitted? It would appear that the only possible exception is the requirement that a PVR application must be written in Thai. For the time being, there are very few individuals with the necessary legal, scientific understanding and language skills capable of translating such applications from foreign languages into Thai. This barrier may deter foreign applicants, but not to the extent of discriminating against them. This language requirement has proven successful in patent application; foreign patent applicants find it difficult to

---

[56]Byrne reports that the Antimonopoly Act has been used almost exclusively to regulate foreign firms dealing with Japanese firms, particularly in the transfer of technology; and commentators have noted that the Act has been enforced hardly ever if at all against anticompetitive practices of Japanese firms on the domestic Japanese market. (Byrne, N. *Negotiating & Drafting Technology Licensing Agreements,* MacMillan, London, 1994.)

translate their applications into Thai. However, a PVR application, compared with a patent application, is relatively simple, requiring less technical information.[57] Therefore, the language barrier in a PVR application may have less effect.

The TRIPs agreement emphasises the importance of effective enforcement; Article 41(1) provides that member States shall ensure the effective enforcement of intellectual property protection.[58] The enforcement shall be reviewed by the TRIPs Council at regular intervals; therefore, inadequate enforcement of a PVR system may involve Thailand in a breach of its obligations under the TRIPs agreement. Deliberate undermining of a PVR system is a dangerous and impractical course of action.

---

[57]For example, under the UK PVR system, an applicant is required to submit completed application form and technical questionnaire. The questionnaire, compared with a patent claim and a specification, is considerably simple. Therefore, the completion of a PVR application does not necessarily require comprehensive technical skill and knowledge of language.

[58]The importance of intellectual property enforcement has been emphasised in a number of occasions. See, for example, Article III (B) of Basic Framework of GATT Provisions on Intellectual Property, Statement of Views of the European, Japanese and United States Business Communities, June 1988; Article IV of Suggestion by the United States for Achieving the Negotiating Objective-Revision , GATT-Doc. MTN.GNG/NG11/W/14 Rev.1 (17th October 1988).

Conclusion

Thailand is not compelled to introduce PVR protection in the immediate future. The reaction of the Thai government to the TRIPs obligation concerning plant variety protection may be viewed as rash and intemperate. The ambiguity found in the TRIPs agreement and relevant agreements may allow Thailand to prolong the period for the introduction of TRIPs plant variety protection for up to 10 year. Furthermore, the possibility that other signatories will seek economic redress from Thailand for failure to provide TRIPs plant variety protection is highly unlikely, given the economic insignificance of seed and plant breeding business between Thailand and other member States. Even though a dispute case might be established, the dispute settlement mechanism is designed to secure a positive solution to a dispute, rather than to punish the accused party. The authorisation of the suspension of concessions and obligations is by no means simple and speedy. The possibility that Thailand may be able to undermine the proposed Plant Variety Protection Act is in reality impractical, given the regular review of enforcement by the TRIPs Council.

Nevertheless, Thailand ultimately has to legislate for one or other form of TRIPs plant variety protection. Further consideration must be given to the following.

1. What form of protection should be introduced? The most appropriate form of plant variety protection, that is to say the form that will benefit, or be likely to benefit, best the country's economy, its seed business and the dependent agricultural sector(s) and prove economic to implement and enforce.

2. When should the protection be introduced? The law should be enacted when it appears prudent to do so, and the status of the country's development (notably,

industrial, technological and economic development) must be the main factor in determining the most appropriate timing.

The investigation in this chapter has been carried out on the assumption that legal protection of plant varieties is not currently available in Thailand. Is this in fact the case? Or does the present legal system allow for this protection? This issue is to be considered in the following chapter.

Appendix 3/1

Some main features of the TRIPs agreement[59]

1. Scope (Art. 1)	Covers main categories of intellectual property rights: copyrights and related rights; trademarks; geographical indicators; industrial designs; patents; layout designs of integrated circuits; and undisclosed information
2. General obligations and basic principles	
National treatment (Art. 3)	Requires all member States to treat nationals of other countries no less favourably than their own nationals on all matters concerning intellectual property rights, subject to certain exceptions already provided in conventions/ treaties related IPRs.
Most-favoured-nation treatment (Art. 4)	Advantages, privileges granted by a member State to the nationals of any other country should be extended unconditionally to the nationals of all other member States.
Exhaustion of IPRs (Art. 6)	For the purposes of dispute settlement, nothing in the Agreement shall be used to address the issue of the exhaustion of IPRs, provided there is compliance with national treatment and most-favoured-nation treatment.
Basic objectives and principles (Arts. 7 and 8)	The protection and enforcement of IPRs should contribute to the promotion of technological innovation and to the transfer and dissemination of technology. They should also contribute to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare and to a balance of rights and obligations. The Agreement allows member States to adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development. At the same time, appropriate measures can be taken in order to prevent the abuse of IPRs or the resort to practices which unreasonably restrain trade or adversely affect the international transfer of technology.

---

[59]This table is from United Nations Conference on Trade and Development, *The TRIPS Agreement and Developing Countries*, United Nations, New York, 1996, pp. 8-12.

3. Enforcement	
General obligations (Art. 41)	Member States must provide effective means of action for any right holder, foreign or domestic, to secure the enforcement of his rights, while at the same time preventing abuse of the procedure
Procedures (Art. 43-50)	The Agreement specifies procedures for civil and judicial action, including means to produce relevant evidence. Civil remedies that must be available must include injunctions, damages and destruction of infringing goods or disposal of these outside the channel of commerce. Provisional measures must be available to prevent infringing activity and to preserve relevant evidence. Judicial authorities must have the authority to adopt provisional measures *inaudita altera parte.*
Indemnification of the defendant (Art. 48)	Compensation for the abuse of enforcement measures are specified, including payment of defendant expenses, which include appropriate attorney's fee.
Acquisition and maintenance of IPRs (Art. 62)	Procedures or formalities for obtaining intellectual property rights should be fair, reasonably expeditious, not unnecessarily complicated or costly, and generally sufficient to avoid impairment of the value of other commitments.
4. Dispute settlement (Arts. 63 and 64)	The new WTO dispute settlement procedures will apply to the TRIPs agreement. Dispute settlement procedures will be faster than in the GATT because of time limits at each stage of the process. There is no scope for interested parties to block the process of the adoption of recommendations of panels.
5. Technical cooperation (Art. 67)	The Agreement calls upon developed country member States to provide technical and financial assistance in favour of developing country member States on mutually agreed terms and conditions.

Appendix 3/2

Main dates in the application of the TRIPs agreement[60]

Activities	Dates
Final Act of the results of the Uruguay Round	15.4.1994
Entry into force of the WTO agreement	1.1.1995
Special arrangements for pharmaceuticals and agricultural chemical products not protected in a member State as of the date of entry into force of the Agreement (Art. 70.8-9)	1.1.1995
Entry into force of TRIPs agreement (Art. 65.1)	1.1.1996
National treatment principles applicable to all member States	1.1.1996
Most-favoured-nation treatment applicable to all member States (Art. 4)	1.1.1996
Review of issue of patentability of plants and animals other than micro-organisms (Art. 27.3(b))	1.1.1999
Transitional arrangement for developing countries (Art. 65.2)	1.1.2000
Transitional arrangement for economies in transition, but only if conditions of Article 65.3 are met	1.1.2000
Transitional arrangement for developing countries concerning product patent protection-to technologies not previously protected by product patent (Art. 65.4)	1.1.2005
Transitional arrangement for least developed countries (Art. 66.1)	1.1.2006

---

[60]This table is from United Nations Conference on Trade and Development, *The TRIPS Agreement and Developing Countries*, United Nations, New York, 1996, p. 35.

Appendix 3/3

Communications with the World Trade Organisation

ORGANISATION MONDIALE
DU COMMERCE

ORGANIZACIÓN MUNDIAL
DEL COMERCIO

WORLD TRADE ORGANIZATION

Centre William Rappard
Rue de Lausanne 154
Case postale
CH - 1211 Genève 21

Téléphone: (41 22) 739 51 11
Ligne directe: (41 22) 739 51 36
Téléfax: (41 22) 739 57 62
Télex: 412 324 OMC/WTO CH
Télégramme: OMC/WTO, GENÈVE

Référence: It154

22 November 1995

Dear Ms. Gredley,

Thank you for your letter of 2 November 1995 requesting documents on the TRIPS ..... negotiations. I enclose the Declaration made at Punta del Este on the Launching of the ..... Uruguay Round in September 1986 and the decisions taken in April 1989 at the Mid-Term Review. I regret that the other negotiating documents remain restricted.

Yours sincerely,

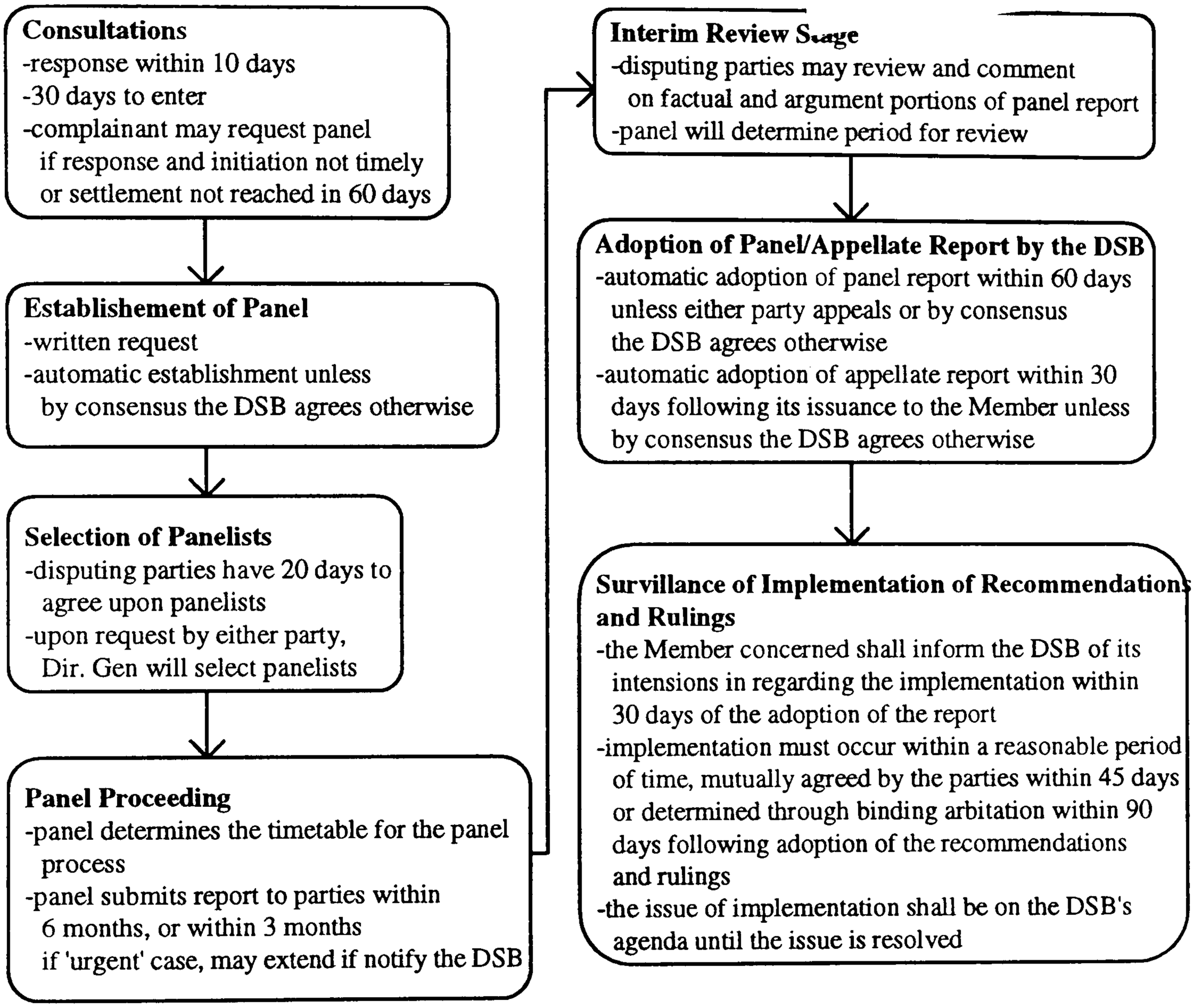
Adrian Otten

Adrian Otten
Director
Intellectual Property and Investment Division

Ms. Ellen Gredley
IP Law Unit
Centre for Commercial Law Studies
University of London
Queen Mary and Westfield College
339 Mile End Road
London E1 4NS

Appendix 3/4

Flowchart of the WTO Dispute Settlement M



Appendix 3/5

A letter to the Director of Intellectual Property and Investment Division

Intellectual Property Law Unit
Centre for Commercial Law Studies
Queen Mary and Westfield College
University of London

1 December 1995

Dear Dr. Otten

I would like to express my sincere appreciation for the documents on the TRIPs negotiations which you kindly sent to Ms. Gredley. They are of great benefit to my doctoral studies. I am researching on the plant variety protection regime in Thailand and background information on TRIPs negotiations is vital to my research. Would you or a member of your division advise me or be able to supply any information on the following points:-

1. Is an effective *sui generis* system for legal protection of plant varieties (normally referred to as a plant breeder's right) a product patent for the purposes of Article 65 of the TRIPs agreement "Transitional arrangements"?;
2. Does the agreement impose the standard of an effective *sui generis* system?;
3. The TRIPs agreement empowers the TRIPs Council to review the implementation of the agreement. What is a next step that the Council will take? Can the Council be a complaining party under a Dispute Settlement mechanism?

I would be most graceful for any further helps that you are able to give, whilst at the same time being aware that certain information must remain confidential.

Yours sincerely,

Tanit Changthavorn

Tanit Changthavorn

Dr. Adrian Otten
Director of Intellectual Property and Investment Division
World Trade Organisation

ORGANISATION MONDIALE
DU COMMERCE

ORGANIZACIÓN MUNDIAL
DEL COMERCIO

WORLD TRADE ORGANIZATION

Centre William Rappard
Rue de Lausanne 154
Case postale
CH - 1211 Genève 21

Téléphone: (41 22) 739 51 1i
Ligne directe: (41 22) 739 51 36
Téléfax: (41 22) 739 57 62
Télex: 412 324 OMC/WTO CH
Télégramme: OMC/WTO, GENÈVE

Référence: It166-ao

2 January 1996

Dear Mr. Changthavorn,

Many thanks for your letter of 1 December 1995 and please accept my apologies for the delay in replying.

..... I hope that you will find the attached article, which was published in the Times of India by the previous Director-General, Mr. Peter Sutherland, helpful in providing responses to your questions. In regard to your third question, only individual Members of the WTO can be complaining parties under the dispute settlement procedures; the TRIPS Council itself cannot be. However, as you point out, the TRIPS Council has the responsibility for monitoring the operation of the Agreement and, in particular, Members' compliance with their obligations under it. During 1995, the Council has reviewed the implementation of those provisions of the TRIPS Agreement that are already in force, notably Articles 65.5, 67 and 70.8. It has also devoted a good deal of time to developing procedures for the notification of relevant information, in particular national implementing legislation pursuant to Article 63, and to establishing procedures for the review of this information.

I wish you good luck with your research.

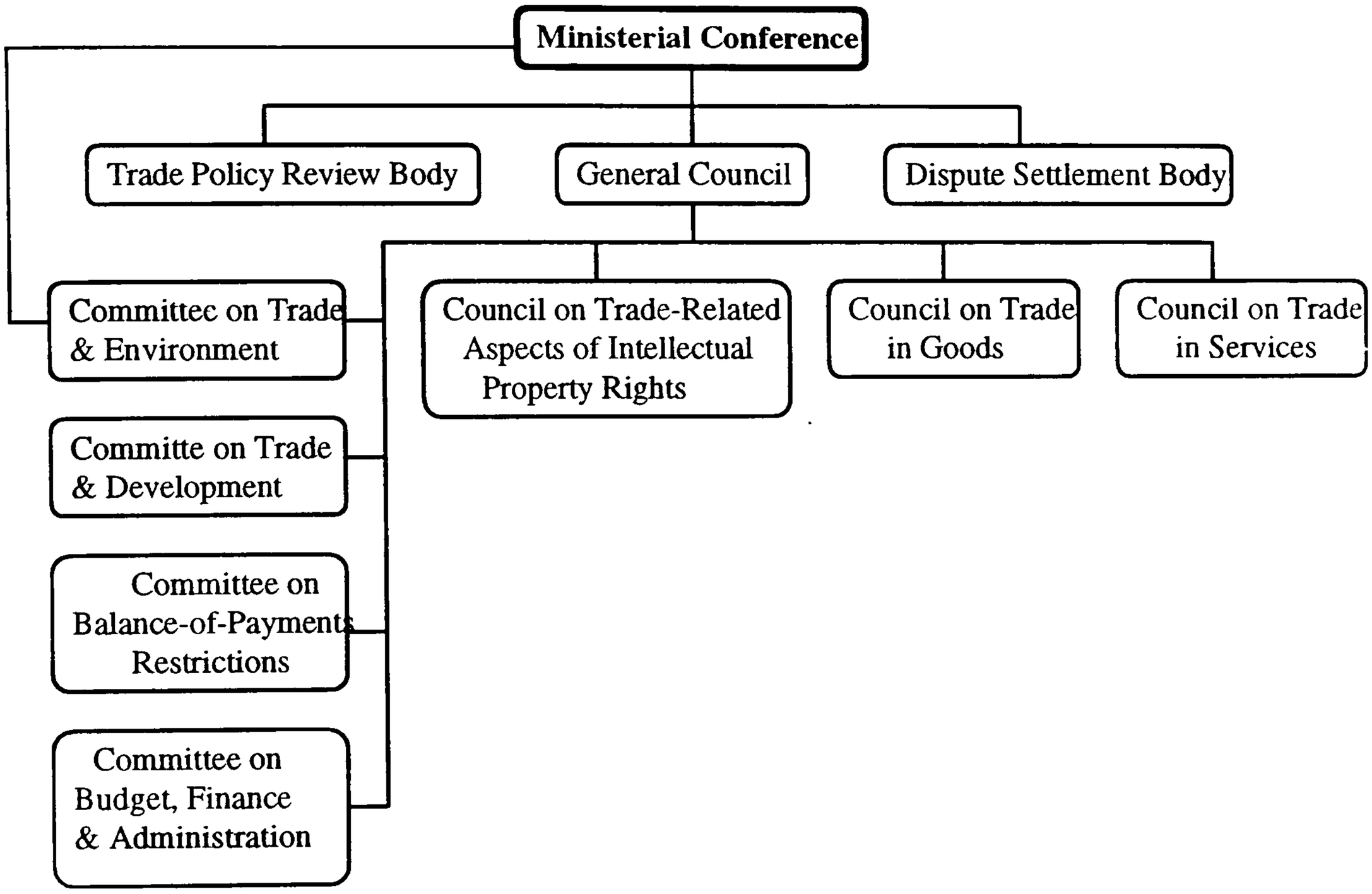
Yours sincerely,

Adrian Otten
Director
Intellectual Property and Investment Division

Mr. Tanit Changthavorn
Intellectual Property Law Unit
Centre for Commercial Law Studies
Queen Mary and Westfield College
University of London
339 Mile End Road
London E1 4NS

Appendix 3/6

World Trade Organisation Structure



CHAPTER 4

LEGAL PROTECTION FOR PLANT VARIETIES IN THAILAND AND TRIPS PLANT VARIETY PROTECTION

Introduction

Thailand's law of intellectual property is relatively undeveloped, even where it exists. The country first introduced protection for literary and artistic works and for trade marks in 1931. But the country and intellectual property protection seem to be an unhappy couple. Thailand has been accused of providing inadequate legal protection for inventions and the other subject matter of intellectual property, particularly by the United States which has imposed trade sanctions in order to press Thailand to improve the protection.

The preceding chapter has addressed a question whether TRIPs plant variety protection ought to be available in Thailand; and discussed the issue of its timed introduction and transition to the new order. This chapter examines the protection currently available in Thailand for new plant varieties. The government has also taken further steps to ensure compliance with the TRIPs obligations on plant variety protection, by considering ratification of the UPOV Convention. Whether or not UPOV ratification is beneficial is open to question.

4.1. The legal system in Thailand[1]

In investigating legal protection for plant varieties under the present Thai jurisdiction, it is necessary and useful to understand the general legal system and its historical background. In some cases there is interaction between different pieces of legislation in a number of respects, such as interpretation and practice.

Thailand is a civil law country; its legal system enforces codified laws. The Thai legal system has a long history, having been crystallised during the Ayuthaya period (1350-1767). The *Dhammasattham* , the law Code of the realm, was established in the early years of the era and formed part of Thailand's national heritage; the law had its roots in supernatural sources revealing the supreme expression of truth and equity. The *Dhammasattham* was fundamentally a law of individual liberty and private rights dealing with both civil and criminal matters. In 1805, King Rama I (1782-1806), the founder of Bangkok, enacted the 1805 Code, normally known as the "Law of the Three Great Seals"; it embraced not only the *Dhammasattham* but also the existing royal decrees and edicts, including laws of evidence, ordeals by fire and water, appeals, as well as law relating to husband and wife. During the reign of King Chulalongkorn (King Rama V), the country witnessed considerable legal developments: the establishment of the Ministry of Justice in 1892 and general law reform. Thailand, in modernising its legal system, adapted the English model, since most members of the legal profession had been trained in England. English law had a considerable influence on Thai legislation and legal practices. For example, the commercial law was introduced under the influence of English law. Where there was neither Thai law nor custom applicable to any

---

[1]The exploration of the Thai legal system is based on Thai Bar Association, *The Administration of Justice in Thailand*, Bangkok, 1969.

commercial matter, the English law was to be applied. Where there was no existing Thai statute or precedent, the King's Courts administered customary law. The custom in commercial matters was generally in accordance with English principles.

In 1908 the Penal Code was promulgated; it contained well-recognised principles of law with certain modifications for the Thai context. Under the Code, six forms of penalty were introduced, notably death, imprisonment, fines, restricted residence, forfeiture of property to the State and bond for keeping the peace. This Code was finally superseded by the Penal Code of 1956.

During the twentieth century, legislative developments included the Civil and Commercial Code, the Code of Criminal Procedure, the Code of Civil Procedure and the Law on the Organisation of the Courts. The Civil and Commercial Code, having been under preparation for over three decades, was published in 1935; it contained 1,755 sections (within 6 books) which laid down general propositions governing civil and commercial matters such as persons, capacity, domicile, obligations, torts, sales, mortgages, hire, agency, cheques, partnerships, companies and other forms of specific contracts, property, marriage and divorce, wills and intestacy. The Code was amended in 1992.

Under the present system, the supreme legislation is the Constitution; the legislation consists of Codes, Acts and delegated legislation (Royal Decrees and Ministerial Regulations). Under the Constitution, legislative supremacy rests with the National Assembly. A Bill may be introduced by either the Government or a member of the Assembly; a Government Bill is the result of either decisions of policy made in the Cabinet or the recommendations of various Departments. During the process of legislation, expert advice is from

time to time obtained from professionals in their specialised fields, such as scientists, engineers and medical experts. Criticism from experts will be heard and on many occasions it has an influence on the legislative process.[2] After passing through all stages in the National Assembly, a Bill is presented to the King for the Royal Assent and becomes an Act. The period of legislation process varies, depending on many factors, especially the urgency of the matter involved. On many occasions, political influence can accelerate or delay the process of legislation. The delay of PVR enactment in Thailand is the direct result of political influence.

The Thai legal system is a hybrid, standing somewhere between the English system (decisions of a court are absolutely binding on all inferior courts in the same hierarchy) and the Continental system (practice established by a uniform line of decisions has strongly persuasive authority). Under the modern court system,[3] a case which has been decided by the Supreme Court may have highly persuasive authority. The Supreme Court is not bound to follow its own decisions; however, in practice, it usually does.[4] Therefore, the precedents of the Supreme Court have played an important role in legal development and practices of the Courts.

---

[2]This is the main reason for the discussion in Chapter 7.

[3]Under the present system, the Courts are divided into three categories: Courts of First Instance (which include the Civil Court, the Criminal Court, Magistrates' Courts, Juvenile Courts and Provincial Courts), the Court of Appeal and the Supreme Court.

[4]This practice results from the Thai culture "If you follow an elder, no dog can bite you". Thais are taught to believe and respect what an elder says; challenging the senior people is unacceptable. This culture is believed to keep the Thai society together; but foreigners, particularly from Western countries, may not understand it. However, this culture may be seen to hinder the legal development in the country.

A derivative and hybrid legal system may create problems. Thai legislators often copy whole pieces of legislation from countries with a legal background different from Thailand; it often happens that difficulties occur as a result of lack of expertise and different attitudes and practices.[5] For example, the Law of Obligations under the Civil and Commercial Code has been taken from the relevant Swiss legislation; but, the court, in interpreting the legislation, tends to follow practices appropriate to the English legal system.

4.2. Intellectual property protection in Thailand

Since the introduction of intellectual property protection in Thailand in 1931, three statutes have been enacted: Trademark Act B.E. 2474 (1931) repealed by Trademark Act 2534 (1991); Patent Act B.E. 2522 (1979) amended by Patent Act B.E. 2535 (1992); and Copyright Act B.E. 2521 (1978). These laws are administered by the Department of Intellectual Property under the Ministry of Commerce.[6] According to the Department of Intellectual Property,

---

[5]Two possible explanations for this phenomenon are that:

1. Most Thai legislators and judges have been educated in common law countries, e.g. the UK and the US; and

2. Language barrier hinders the access to (and understanding of) legislation in non English speaking countries, such as Germany and France.

Accordingly, it is anticipated that a number of provisions and practices under the UK and US intellectual property regimes, such as remedies, will be introduced in the Thai system.

[6]The Department's responsibilities are to:

1. register patents, trademarks, service marks, certificate marks, collective marks and licensing on intellectual property rights;

2. develop systems, patterns and means to protect intellectual property properly and effectively;

3. promote uses of intellectual property, including technology information from patent documentation for education, research, development and application in commercial production; and

4. study, analyse and recommend policy on intellectual property to the government.

approximately 13,000 applications for trademarks, service marks, certificate marks and 500 patent applications have been filed annually. Applications have been steadily increasing; patent applications, for example, have increased by 242 per cent during the last decade. Most applicants are well-established companies.

The Thai intellectual property protection system has been criticised for its weakness because of the prevalence of intellectual property infringement in the country. However, few cases of infringement have been brought to court; most reported cases concern copyright and trade mark disputes. The main reasons for the scarcity of cases are:

(1) Slow litigation. Currently, civil cases are heard in instalments with an average of one day of hearing per month. As a consequence, a civil action may take up to six years if it goes to the Supreme Court (it usually takes one to two years at the Court of First Instance, one to two years at the Court of Appeal and one to two years at the Supreme Court).[7]

(2) Low compensation. Section 438 of the Civil and Commercial Code provides that compensation may include restitution of the property of which the injured person has been wrongfully deprived or its value as well as damages to be granted for any injury caused. In practice, the Thai Court calculates damages on the basis of actual loss, i.e. loss which already took place. Therefore, in the case that intellectual property has not been exploited commercially, damages awarded by the Court may be very low.

(3) Ineffective enforcement.

(4) Thai attitude of face-saving. The Thai temperament inclines towards compromise in preference to litigation[8]

---

[7]Naumann, M. et al. "Grand Hopes for New Court" [November 1996] 9 IP Asia 32.

[8]It is a Thai belief "Eating faeces is better than going to court". Therefore, parties in dispute tend to compromise if possible.

Very few Thai judges are specially trained to deal with intellectual property disputes, especially patent infringement which requires a wide array of knowledge, including technology and law. Nonetheless, in 1996 the Thai government passed the Act for the Establishment of and Procedure for Intellectual Property and International Trade Court. The Intellectual Property and International Trade Court (IP&IT Court) has been operating since 1997. Under the Act, a number of intellectual property and international trade courts will be established in several provinces, including Bangkok, Samut Prakan, Samut Sakhon, Nakhon Pathom, Nonthaburi, and Pathum Thani. The Courts have jurisdiction over civil and criminal cases with respect to intellectual property protection.[9]

The establishment of the IP&IT Court marks the high point of development of the Thai intellectual property regime,[10] it means that Thailand can comply with

---

[9]The jurisdiction also covers civil and criminal cases in relation to economic crimes, international trade and international financial instruments, civil disputes in relation to credit facilities or services of commercial banks or other financial institutions for international trade, arbitration awards, maritime disputes, market dumping and any other matter which any Act or Royal Decree specifies to be under the jurisdiction of this court. (Somwaiya, K. "Intellectual Property and International Trade Court Bill" [October 1994] 8 IP Asia 30.
Section 7(9) of the Bill provides that the Court has jurisdiction on civil and criminal cases with regard to plant breeder's right protection. In drafting this provision, legislators have expected the forthcoming introduction of the protection.

[10]Developmental features include:
(1) Streamlining hearing process: Section 27 of the Act provides that the Court shall proceed with the hearing without adjournment until the hearing is over, save in the case of unavoidable necessities. After the hearing is over, the court shall promptly render a judgement or order.
(2) Adequate remedies: In order to comply with the requirement in Article 50 of the TRIPs agreement, a number of remedies have been introduced in the Thai intellectual property regime. Two important remedies are preventive injunctions and Anton Pillar Orders

the TRIPs obligations on enforcement, and thus satisfy many countries, particularly the US.

Before the establishment of the IP&IT Court, cases concerning intellectual property disputes were brought before the Civil Court under the Court of First Instance. The Civil Court deals with all matters concerning civil and commercial aspects and it is unreasonable to expect the Civil Court to be well-informed about a complicated subject like intellectual property. The IP&IT Court is specially designed to deal with the complexity of intellectual property laws, in particular patent law. Each panel of judges will comprise at least three members, one of whom is an associate judge specialising in the particular field. An associate judge, particularly in patent cases, will play an important role assisting professional judges (who may lack relevant technical knowledge) to decide a case.[11] Nevertheless, the establishment of the Court may pose problems, as there may not be enough local specialists with knowledge of science and law. At present there are very few specialists in the fields of patents (especially, biotechnology patents) and PVR.[12]

4.2.1. Thailand and the UPOV Convention

Thailand has joined only one international intellectual property convention, viz the Berne Convention. Recently the government has been considering whether

---

[11]Scientific knowledge is very important in patent litigation. Dillon LJ. in *Genentech Inc's Patent* [1989] Reports of Patent, Design and Trade Mark Cases 147 (Court of Appeal) at 235 stated that without the explanation from Dr. Sydney Brenner (Director of the Molecular Genetics Unit of the Medical Research, UK) he would not have come even remotely near to achieving some glimmering of what the scientific issues in the case were about.

[12]The government should seek assistance from developed countries, as suggested by provision under Article 67 "Technical Cooperation" of the TRIPs agreement.

to join the Paris Convention and the UPOV Convention. Is the ratification of the UPOV Convention beneficial to Thailand?

4.2.1.1. National treatment

The UPOV Convention is the only international convention concerning PVR protection. At present, there are more than 30 member countries, including developed and developing countries. The Convention provides an important advantage from the principle of national treatment.[13] Under this principle, nationals of one member State can enjoy the same treatment as is accorded by the laws of other member States to their own nationals; therefore, a breeder in one UPOV member State can seek PVR protection for his variety in other member States, provided his variety meets the statutory requirements. But are Thai breeders likely to need PVR protection for their varieties in other countries? Have varieties bred in Thailand been misappropriated in other countries? Many plant varieties developed by Thai breeders, e.g. rice and orchid varieties, have enjoyed commercial success in the global market. The success of these varieties may attract other competitive countries to misappropriate these varieties. Although smuggling plant varieties from Thailand is not difficult,[14] there has never been any complaint from Thai breeders in this respect. Plants are susceptible to climatic conditions, i.e. plants of a similar variety may yield products with different qualities if they are planted in different climates. It has been reported that some countries have

---

[13]National Treatment is the most fundamental principle in international intellectual property law. It is part of all conventions on intellectual property.

[14]The main reasons are as follows:

(1) Regulatory controls are ineffective; and

(2) Modern biotechnological techniques facilitate the smuggling. For example, a small part of plant materials is needed to be propagated by the technique of tissue culture. (See Chapter 1 for more details)

attempted to grow a well-known Thai rice variety "Aromatic rice", but failed because their environmental conditions were not conducive to produce crop of comparable quality. The smuggled plants have to be developed to be adaptable to a new environment. It may be argued that modern techniques, e.g. genetic engineering, may facilitate so-called "cosmetic breeding". This concern has been discussed in the Convention on Biological Diversity.[15] The Convention has introduced the principle of "sovereignty over natural resources".[16] Access to genetic resources under Article 15(3), (4) and (5) requires prior informed consent and must be on mutually agreed terms. Article 19(2) provides that member States shall take all practicable measures to promote and advance priority access on a fair and equitable basis.[17] The country providing genetic resources is entitled to benefit from the commercial exploitation of its genetic resources (Article 15(6)). Such sharing is based on mutually agreed terms (Article 15(7)).

Thailand can enjoy similar benefit from the principle of national treatment under the TRIPs agreement. The TRIPs agreement imposes the principle of national treatment concerning all areas of intellectual property protection.[18]

---

[15]On 5th June 1992, at Rio de Janeiro, representatives of more than 150 countries signed the Convention on Biological Diversity.

[16]As it is reaffirmed in the preamble of the Convention that States have sovereign rights over their own biological resources. Article 15(1) provides that recognising the sovereign rights of States over their natural resources, the authority to determine access to genetic resources rests with the national governments and is subject to national legislation. At present, the Thai government has been drafting such legislation.

[17]This obligation is also mentioned in Article 1 of the Convention: "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate transfer of relevant technologies taking into account all rights over those resources and to technologies, and by appropriate funding."

[18]One role of the national treatment obligation is to serve the need of exporting countries for access to legal rights and remedies in foreign markets. The United States of America, the

Article 3 of the agreement provides that each member State shall accord to the nationals of other members treatment no less favourable than that it accords to its own nationals with regard to the protection of intellectual property. Member States may exempt the application of the principle where such exceptions are necessary to secure compliance with laws and regulations which are not inconsistent with the provisions of this Agreement and where such practices are not applied in a manner which would constitute a disguised restriction on trade; for example, exceptions concerning judicial and administrative procedures, including the designation of an address for service or the appointment of an agent within the jurisdiction of a member State. The TRIPs agreement repeats the principle of national treatment by obliging member States to comply with Article 1-12 and 19 of the Paris Convention (1967); particularly, Article 2 of the Paris Convention imposes the principle of national treatment.[19]

European Union and Japan have captured the agenda in order to provide in the TRIPs agreement a self-serving document which will monopolise markets particularly in developing countries to the detriment of local manufacture. (See Evans, G. E. "The Principle of National Treatment and the International Protection of Industrial Property" [1996] 3 European Intellectual Property Review 149.)

In fact, developing countries demanded for "preferential or special treatment". Although this demand was taken into account in the general negotiating principles of Punta del Este, and was once more reflected in the midterm review of TRIPs, the Agreement did not accord developing countries a special status. (Pacón, A.M. "What will TRIPs Do for Developing Countries"; in Beier, F-K, et al. (eds.) *From GATT to TRIPs - The Agreement on Trade-Related Aspects of Intellectual Property Rights,* Max Planck Institute for Foreign and International Patent, Copyright and Competition Law, Munich, 1996, pp. 333-334.)

[19]Article 2 of the Paris Convention provides that:

1. Nationals of each of the countries of the Union shall, as regards the protection of industrial property, enjoy in all the other countries of the Union the advantages that their respective laws now grant, or may hereafter grant, to nationals, without prejudice to the rights specially provided by the present Convention. Consequently, they shall have the same protection as the latter, and the same legal remedy against any infringement of their rights, provided they observe the conditions and formalities imposed upon nationals.

4.2.1.2. Technical assistance

The UPOV Convention itself does not make any specific mention of technical assistance which should be provided to the member States. The Convention is silent also about institutional structures for implementing Convention. However, the Convention includes practical measures to encourage cooperation between member States:

(1) UPOV Technical Guidelines;[20]

(2) Various forms necessary for administrative procedures;

(3) Standards for the charging of fees and for variety denominations;

(4) Models for technical information exchange between member States;

(5) A Model Law on plant variety protection.

UPOV technical assistance is mainly in the form of information and encouraging cooperation between member States.[21] However, the main problem that Thailand will encounter if PVR protection is to be introduced in the immediate future is a lack of infrastructure including technology, financial

---

2. However, no condition as to the possession of a domicile or establishment in the country where protection is claimed may be required of persons entitled to the benefits of the Union for the enjoyment of any industrial property rights.

3. The provisions of the laws of each of the countries of the Union relating to judicial and administrative procedure and to jurisdiction, and to the election of domicile or the designation of an agent, which may be required by the laws on industrial property, are expressly reversed.

[20]The Technical Working Parties of the Technical Committee have been developing technical guidelines for the conduct of tests with the individual species. The guidelines aim to give recommendations for the national authorities of which characteristics are suited for the test and in which they should be observed. The guidelines provide information about the latest variety examination technology and a reference for experts from countries where PVR systems are newly established.

[21]UPOV information is accessible without the need to ratify.

support and trained personnel. Thailand can seek technical assistance in these areas through Article 67 "Technical Cooperation" of the TRIPs agreement.[22]

An analysis of the advantages and disadvantages of UPOV ratification suggests that Thailand should not ratify the convention. Two main advantages that Thailand will gain from the ratification are also provided by the TRIPs agreement. Ratification of the UPOV Convention will also limit the choices of PVR systems. After 31st December 1995, Thailand cannot ratify the 1978 UPOV Convention.[23] This will leave only one choice of PVR system, i.e. that established under the 1991 UPOV text and this text would not appear to be suited for a country at Thailand's stage of development.[24] Furthermore, there is

---

[22]Article 67 of the TRIPs agreement requires developed country Members to provide, on request and on mutually agreed terms and conditions, technical and financial cooperation in favour of developing country and least-developed country Members. This Article specifies that such assistance must include assistance in the preparation of laws and regulations on the protection and enforcement of intellectual property rights as well as on the prevention of their abuse, and support regarding the establishment or reinforcement of domestic offices and agencies relevant to these matters, including the training of personnel.
Technical cooperation is the main feature in the agreement between the World Intellectual Property Organisation (WIPO) and the World Trade Organisation. The cooperation agreement provides that the International Bureau of WIPO and the WTO Secretariat shall enhance cooperation in their legal-technical assistance and technical cooperation activities relating to the TRIPs agreement for developing countries. The assistance made available by each Secretariat to the members of its own organisation will be available to the members of the other organisation. (Information from Website HTTP://WWW.WTO.ORG)

[23]Article 37(3) of the 1991 UPOV text provides that no instrument of accession to the Act of 1978 may be deposited after the entry into force of this Convention according to this Convention according to paragraph (1), except that any State that, in conformity with the established practice of the General Assembly of the United Nations, is regarded as a developing country may deposit such an instrument until December 31, 1995, and that any other State may deposit such an instrument until December 31, 1993, even if this Convention enters into force before that date.

[24]As mentioned in Chapter 2, the 1991 UPOV requirement that PVR protection has to be available for all plant genera and species causes concern for countries without the adequate

no political pressure on Thailand to ratify the UPOV Convention, which mainly deals with the issue of plant variety protection. In the absence of economic or political pressures, Thailand's options remain free and open.

4.3. TRIPs plant variety protection

The TRIPs agreement aims to harmonise the standards of intellectual property protection throughout the world. The agreement imposes the minimum standards for copyright and related rights, trademarks, geographical indications, industrial designs, patents, layout-designs (topographies) of integrated circuits, and protection of undisclosed information.

In the second sentence of Article 27(3)(b), the TRIPs agreement obliges member States to provide legal protection for plant varieties by three possible means: patents, an effective *sui generis* system, or any combination thereof. The meaning of this provision is open to discussion.

4.3.1. Patents

Even though the TRIPs agreement does not introduce any new concept of a patent, it constitutes an important milestone in patent law at the international level.[25] After the long GATT negotiations between industrialised and

---

infrastructures for either administrative or technical examinations, like Thailand. Furthermore, it is questionable whether PVR protection is beneficial to the economic development of Thailand.

[25]Straus states that the agreement reduces the deficits in protection that were inherent in the Paris Convention owing to the lack of minimum rights in that Convention, a situation which it was only possible to remedy within the context of regional patent harmonisation in states with a similar stage of development, societal and economic systems and legal traditions. (Straus, J. "Implications of the TRIPs Agreement in the Field of Patent Law"; in Beier, F-K.

developing countries,[26] the agreement presents mandatory rules on the subject matter eligible for patent protection and related general requirements (Articles 27 and 29), on the effects of the patent rights conferred (Article 28), the duration of the term of protection (Article 33) and as to who bears the burden of proof in the case of infringement of process patents (Article 34).[27,28] The agreement requires changes to patent laws in many countries.[29]

4.3.2. An effective sui generis system[30]

The term "sui generis system" has not been defined by the agreement; nonetheless, it has been suggested that the system refers to a PVR system.[31] Is

---

et al. (eds.) *From GATT to TRIPs - The Agreement on Trade-Related Aspects of Inteliectual Property Rights,* Max Planck Institute for Foreign and International Patent, Copyright and Competition Law, Munich, 1996, p. 214).

[26]Industrialised countries tried to impose high standards of the protection whereas the other side disagreed with this proposal. See Appendix 4/1 for proposals by industrialised countries.

[27]Straus, J. "Implications of the TRIPs Agreement in the Field of Patent Law"; in Beier, F-K, et al. (eds.) *From GATT to TRIPs - The Agreement on Trade-Related Aspects of Intellectual Property Rights,* Max Planck Institute for Foreign and International Patent, Copyright and Competition Law, Munich, 1996, p. 178.

[28]See Appendix 4/2 for main features of TRIPs-patent protection.

[29]Straus opines that the implications of TRIPs are by no means confined to the necessary amendments of the patent laws of numerous threshold and developing countries, but also engender amendments to the patent laws of a number of industrialised countries. (Straus, J. "Implications of the TRIPs Agreement in the Field of Patent Law"; in Beier, F-K, et al. (eds.) *From GATT to TRIPs - The Agreement on Trade-Related Aspects of Intellectual Property Rights,* Max Planck Institute for Foreign and International Patent, Copyright and Competition Law, Munich, 1996, p. 215)

[30]This option was not referred in Suggestion by the United States for achieving the negotiation objective (GATT-Doc. MTN.GNG/NG11/W/14 Rev. 1, 17th October 1988) and Guidelines and Objectives Proposed by the European Community for the Negotiations on Trade Related Aspects of Substantive Standards of Intellectual Property Rights (GATT-Doc. MTN.GNG/NG11/W/26, 7th July 1988).

this correct? "*Sui generis*" literally means "of its own kind; the only one of its kind"; therefore, a *sui generis* form of protection for plant varieties means a special title of protection. In countries where there is no room left for patent protection of plant varieties, a special system has been designed specially to protect plant varieties, including Plant Patents Act and PVR regime.

One model for a *sui generis* system is currently provided under the UPOV Convention.[32] There are two PVR systems which have been developed under the UPOV Convention: the 1978 system and the 1991 system. Yet, the TRIPs agreement makes no specific mention of the UPOV Convention (either the 1978 or 1991 texts).

The TRIPs agreement does not impose any particular standard of PVR protection; but it stipulates that the system must be effective. Some commentators suggest that the *sui generis* system adopted by a country should be modelled on systems in countries dominant in the WTO, in particular developed countries like the US or the UK. In other word, to be effective a system should adopt the form and principles established by the 1991 UPOV Convention.[33] There is nothing in the TRIPs agreement which definitely

---

[31]See, for example, Correa, C.M. "The GATT Agreement on Trade-related Aspects of Intellectual Property Rights: New Standards for Patent Protection" [1994] 8 European Intellectual Property Review 32.

[32]For example, Verma, S.K. "TRIPs and Plant Variety Protection in Developing Countries, [1995] 6 European Intellectual Property Review 281, at 289 and the remark of Mr. Geuze, the delegate General Agreement on Tariffs and Trade, in the 1991 Diplomatic Conference for the Revision of the International Convention for the Protection of New Varieties of Plants. (International Union for the Protection of New Varieties of Plants, *Records of the Diplomatic Conference for the Revision of the International Convention for the Protection of New Varieties of Plants*, Geneva, 1991, p. 180.)

[33]See, for example, Nijar, G.S. et al. "Intellectual Property Rights: the Threat to Farmers and Biodiversity" [1994] 39 Third World Resurgence 35.

restricts or limits Thailand's choice of an appropriate means to protect plant varieties.

4.3.3. Any combination thereof

"Combination" in Article 27(3)(b) TRIPs suggests that plant varieties can be protected under both patent and PVR systems; as in the USA where a plant patent regime coexists with PVR protection.[34] This option appears to be consistent with the removal of the ban on double protection for plant varieties under the 1991 UPOV Convention.[35] The combination[36] undeniably provides more possibility for protection; therefore, it seems to be less beneficial in a country where such strong protection for local industries is not necessary.

At this point, it must be asked what the TRIPs agreement means by "plant varieties". The agreement, either accidentally or intentionally, does not define the term "plant varieties"; the interpretation of which is therefore, left to member States. Does the term "plant varieties" include all varieties of plants? If it embraces the whole kingdom of cultivated plants, making more varieties

---

[34]In the USA, protection under the Plant Patent Act 1930 (35 U.S.C. 161) is available for asexually reproduced plant varieties. The Plant Variety Protection Act 1970 provides protection for sexually reproduced plant varieties. Utility patents under 35 U.S.C. 101 have been issued for plant genes, seeds, plant parts, cultivars and hybrids, for example, sunflower (*Helianthus annuus L.*), Potato (*Solanum tuberosum L.*) cultivar and Squash (*Cucurbita pepo L.*) cultivar. (*Intellectual Property Rights Associated with Plants,* ASA Special Publication No. 52, Crop Science Society of America, et al. Madison, Wisconsin, USA, 1989, p. 8.)

[35]The 1978 UPOV Convention allows a member State to recognise the right of the breeder provided for in this Convention by the grant either of a special title of protection or of a patent.

[36]Choices of combination may be:

(1) PVR and plant patents;

(2) PVR and patents; and

(3) PVR, plant patents and patents.

eligible for the protection, a PVR system may be less attractive for a country like Thailand.

It is questionable whether the TRIPs agreement, when it was drafted, intended to follow the direction of the 1991 UPOV Convention; the revised Convention provides that each Member State must provide legal protection for all plant genera and species. However, there has been no documentary evidence showing the link between the TRIPs agreement and the UPOV Convention, i.e., the TRIPs agreement has never mentioned the UPOV Convention.

The TRIPs plant variety protection requirements may be seen as a "dish without ingredients" provision. The agreement leaves the details to the discretion of member states.[37] The Thai government should take advantage of the lack of clarity in the TRIPs obligation to provide plant variety protection by applying a "contra proferentem" rule of construction in the manner which will be most beneficial to the country.

4.4. Current legal protection for plant varieties in Thailand

Does Thailand already have legislation which could protect plant varieties? If so, what is this legislation? Does it meet the TRIPs obligation concerning plant

---

[37]Straus suggests that the wording of this obligation leaves the choice of the protection system entirely to the Members, reflecting on the one hand the broad range of existing systems, ranging from the US at one end, where plant varieties may be protected by patents or by specific variety protection rights, to the EC countries at the other end, where plant variety protection is confined to specific variety protection systems. (Straus, J. "Implications of the TRIPs Agreement in the Field of Patent Law"; in Beier, F-K, et al. (eds.) *From GATT to TRIPs - The Agreement on Trade-Related Aspects of Intellectual Property Rights*, Max Planck Institute for Foreign and International Patent, Copyright and Competition Law, Munich, 1996, p. 186.)

variety protection? A survey of current legislation should help the Thai government to decide whether it has to take further action to comply with the TRIPs obligation.

4.4.1. Legal protection under the Civil and Commercial Code

Under the Thai legal system, the 1992 Civil and Commercial Code deals with disputes over commercial matters, including contract, tort, company and property. An intellectual property dispute is primarily a civil action. Prior to the introduction of intellectual property legislation in Thailand, this Code was the main protective measure for intellectual property. Section 420 provides that anyone who, wilfully or negligently, unlawfully injures the life, body, health, liberty, property or any right of any person, commits a wrongful act and is bound to make compensation therefor.

The scope of protection under Section 420 is relatively ambiguous, compared to that of statutes on intellectual property. The word "injure" is not defined by the Code; but many Thai legal experts have taken the view that "injure" should be interpreted broadly, and that resulting injury may include physical or mental, visible or invisible injury. For example, the unauthorised use of a patented product which may cause the loss of sale of the product can constitute an "injury".

Section 420 requires a person who unlawfully injures property or any right of another person, *inter alia,* to repair the damage done by compensating the injured or aggrieved party. The Court must determine the manner and the extent of compensation in accordance with the circumstances and the gravity of the wrongful act. Compensation may include restitution of the property of which the injured person has been wrongfully deprived or its value as well as

monetary reparation (damages) for any injury caused. The claim for damages arising from a wrongful act is barred by prescription after one year from the day when the wrongful act and the person bound to make compensation became known to the injured person, or ten years from the day when the wrongful act was committed.

Has an inventor or a breeder a right over his product for the purposes of this section? The language in this Section renders the scope of protection very wide. The term "any right" has been defined in the Code; but the term has been used to cover all rights recognised by laws, including rights over property, life and liberty. Section 1298 provides that real rights over property may be created by virtue of this Code or other laws. Thus, any right which is recognised by Thai law constitutes a right for the purposes of section 420. In 1964, when Thailand had no patent law, the Supreme Court ruled that technical inventions were not protected by the Code.[38] It would follow from that, that plant varieties are not at present protected by the Code against misappropriation, for want of a statute establishing a system for their legal protection. When a PVR statute in passed by the legislature in Thailand, a breeder will enjoy double protection for his work: protection by PVR (assuming such a right is granted to a breeder) and protection under the general principles in the Code.

---

[38]See Case 837/2507 where a plaintiff was the owner of a pharmaceutical "Oxytetracycline" patented in the US. The plaintiff alleged that a defendant infringed his patent by producing and importing oxytetracycline. The defendant contended that patent law had not been enacted in Thailand; therefore, the plaintiff had no exclusive right over this product in the country. The plaintiff responded that although the law had not been enacted, he had a right over this product under Section 420 of the Code because a patent was right in rem. The Supreme Court took the view that a right which the plaintiff claimed was not a legal right under the Thai legal regime; therefore, it was not a property under the Code. The Court, hence, dismissed the case.

Under the Code trade secrets and other confidential information may be protected through contractual obligations created by duly executed agreements between the contracting parties.

4.4.2. Legal protection under the Penal Code

The Penal Code has been in force in Thailand since 1908 and revised in 1956. A person shall be criminally punished only when the act committed is an offence and the punishment is defined by the law in force at the time of the doing of such act, and the punishment to be inflicted on the offender shall be that provided by the law. The Code has a provision dealing with offences relating to trade; Section 272 (1) of the Penal Code provides that the use of a name, figure, artificial mark or any wording in the carrying on trade of the other person constitutes a statutory offence. The language in this Section is quite clear that the protection conferred shall not extend to an invention (including a plant variety);[39] yet, the protection may extend to a varietal name.

---

[39]See Case 386/2509 where a plaintiff was a torch producer located in the US and exported a product to Thailand. The plaintiff alleged that a defendant produced a torch "Pilot" identical to his torch. The defendant contended that according to the lack of patent protection in Thailand, the plaintiff had no right to prevent others from using or producing the product. The Supreme Court took the view that despite the lack of patent protection, Section 272 (1) of the Penal Code provided certain protection for the mark. However, in a civil action, there was no provision concerning the use of a product identical to a product of other; therefore, the Court dismissed the case.

Also see Case 353/2510 where a plaintiff was a producer of a torch called "Winchester". The plaintiff's torch was patented in the UK in September 1963. The plaintiff alleged that a defendant committed a wrongful act under Section 272 (1) of the Penal Code by producing and marketing a torch identical to "Winchester". The Supreme Court interpreted the language in the Section that the protection conferred by the Code covered the unauthorised use of a trade mark which caused confusion to the public, not the production of a torch identical to "Winchester"; therefore, it was not a criminal action for the defendant to produce a torch identical to "Winchester".

Another form of legal protection conferred by the Code is that for private secrets. Section 324 provides that it is a statutory offence that a person, by reason of his function, profession or calling of trust, having known or acquired a secret concerning industry, discovery or scientific invention, discloses or makes use of such secret for the benefit of himself or the other person. Penalties include an imprisonment (not exceeding six months) or a fine (not exceeding one thousand baht) or both. Despite the broad scope of statutory subject matter, a plant breeder may not get adequate protection because of the weakness of the protection, including its narrow scope and its inadequate remedy. This legal protection for confidentiality is a criminal action; thus, no monetary compensation can be claimed.

In sum, the protection conferred by the Penal Code does not extend to an invention (including a plant variety); however, secret protection may be used to prevent the disclosure of secrets, especially in industries where R&D is carried out by employees.

It follows that even though the two Thai Codes appear to provide legal protection for plant varieties, the two pieces of legislation cannot fit with any option provided by the TRIPs agreement.

4.4.3. Patent protection for plant varieties[40]

A patent statute was introduced in Thailand in 1979 and thereafter amended in 1992. In general, the legislation is similar to the UK Patents Act. A patent may be granted for an invention in respect of which the following conditions are

---

[40]Also see Appendix 4/3 for patent protection in Thailand.

met: novelty, inventive step and industrial application. The exclusive rights conferred by patents cover the production, use, sale, disposal, offer for sale and import of patented inventions. The term of protection lasts 20 years from the date of application. The authorities involved (including the Department of Intellectual Property and the court) tend to follow practices in other countries where patent laws are well developed; nevertheless, certain differences resulting from national policy and practice may be found. The TRIPs agreement does not bring much change to patent law in Thailand.

Section 3 of the Act defines "invention" as any discovery or invention resulting in a new product or process, or any improvement of a product or process. "Process" means any process, art or method of producing, maintaining or improving the quality of a product, including the application of such process. Certain plant breeding techniques are therefore patentable if they satisfy the statutory requirements. Inventions concerning new products cover a wide range, possibly including plant varieties. Despite being regarded as an invention, a plant variety is expressly precluded from patentability by Section 9(1) of the Act. According to its literal translation, the provision excludes plants, amongst other inventions, from patentability. The Act does not define the term "plant"; nonetheless, the term is likely to be construed as covering both plants and plant varieties. The main reason for this presumption is the government's belief that patent protection for plants and plant varieties (which are major commodities) may cause negative consequences, such as obstructed access to , and increasing cost of, new varieties.[41] No study into this matter has been undertaken in Thailand. A rigorous investigation would require expertise and government interest, both of which are conspicuously absent. So far there has been no complaint from private and public sectors about the absence of

---

[41]These concerns are to be discussed in Chapter 7.

patent protection for plants and plant varieties. It is unclear whether plant materials, e.g. cells and protoplasms, are patentable. No patent application for an invention with regard to plant materials has to date been made.

Plants and plant varieties cannot be protected in Thailand either by intellectual property law or by other legal means. For this reason, Thailand must meet its TRIPs obligations by introducing adequate protection of plant varieties.

Conclusion

Despite its long traditions, the legal system of Thailand is still in many respects far behind those of developed countries. Thai intellectual property protection, in particular, has been criticised as inadequate. The pressure to improve intellectual property protection has become more intense since the establishment of the WTO agreement, and the TRIPs agreement imposes high standards of intellectual property protection, including three options of protection of plant varieties.

Under the present Thai jurisdiction, neither intellectual property law nor other laws provide the protection for plant varieties that is required by the TRIPs agreement. Therefore, the government has taken a right decision of introducing legal protection for plant varieties.

An investigation of the advantages and disadvantages of UPOV ratification suggests that Thailand should not ratify the Convention. Equivalent benefit may be obtained from the TRIPs agreement.

Appendix 4/1

Selected documents concerning patent protection by industrialised countries

The following paragraphs show certain provisions in documents concerning patent protection proposed by some industrialised countries during the negotiation on trade-related aspects of intellectual property rights, including trade in counterfeit goods. These documents are extracted from Beier, F-K. et al. (eds.) *GATT or WTO? New Ways in the International Protection of Intellectual Property,* IIC Studies Vol. 11, Max Planck Institute for Foreign and International Patent, Copyright, and Competition Law, Munich, 1989.

Suggestion by the United States for Achieving the Negotiating Objective-Revision, GATT-Doc.MTN.GNG/NG11/W/14 Rev.1 (17th October 1988):

Patentable Subject Matter and Conditions for Patentability

A patent shall be granted for all products and processes which are new, useful, and unobvious. In this regard, the terms "useful" and "unobvious" encompass or are synonymous with the terms "capable of industrial application" and "inventive step". Examples of items which do not meet these criteria are: materials consisting solely of printed matter, scientific principles, methods of doing business, and algorithms and mathematical formulas per se, including those incorporated in computer programmes. A patent application or a patent, however, may be withheld from publication if disclosure of the information contained therein would be detrimental to the national security.

Guidelines and objectives proposed by the European Community for the negotiations on trade related aspects of substantive standards of intellectual property rights, GATT-Doc.MTN.GNG/NG11/W/26 (7th July 1988):

Patents shall be granted for any inventions, whether products or processes, which are susceptible of industrial application, which are new and which involve an inventive step. Patents shall be available for inventions in all fields of technology, except for:

- inventions the publication or exploitation of which would be contrary to ordre public or morality;
- plant and animal varieties or essentially biological processes for the production of plants and animals; this does not apply to microbiological processes or the products thereof.

Notes on Informal Meeting on Intellectual Property Standards 7-11th March 1988 (The notes contain a reproduction of the intellectual property rights and enforcement standards developed by the United States and a brief summary of the informal reactions and comments offered by the delegations from 23 industrialised nations plus the European Commission.)

Patentable subject matter

"1. Subject to the provisions of this document, a patent shall be granted for all products and processes.

Note 1: Generally all subject matter is to be considered patentable under paragraph 1. Exceptions may be made with respect to materials consisting solely of printed matter, scientific principles, methods of doing business, and algorithms and mathematical formulas per se, including those incorporated in computer programmes, because they are not regarded as satisfying the standards or conditions for patentability. In addition, inventions useful solely in

the utilisation of special nuclear material or automatic energy weapons may be excepted from patentable subject matter."

Delegations expressed general support for the US. approach to a comprehensive definition of patentable subject matter. For example, all delegations believed pharmaceutical and chemical products should be patentable. Three delegations noted that amendments to their national laws to permit patenting of pharmaceuticals would enter into force in the early or mid-1990's.

There was general agreement with the exclusions from patent protection indicated in Note 1, with the exception of the proposed exclusion for nuclear materials (where delegations questioned the consistency of this exclusion with the general approach). Some delegations noted that there were exclusions in their laws for plants, animals and methods of treatment of humans and animals and that these should be accommodated.

Some delegations stated that their systems provided broadly stated authority to exclude subject matter from patentability, for example, to protect public order or morality. However, there was strong support for limiting exclusions under such general authority in order that they not become a basis for protectionist actions. There was also strong support for the concept that the use of such general authority to make exclusions not be used to validate existing subject matter specific exclusions.

Appendix 4/2

Main features of TRIPs-patent protection

(1) Patentable subject matter: The agreement provides that all TRIPs member States must make patents available for both product and process inventions in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application. The agreement allows member States to use offence against *ordre public* or morality as a permissible ground for exclusion from patentability. Member States may exclude from patentability certain inventions, including plants and animals other than microorganism, and essentially biological processes for the production of plants and animals other than non-biological and microbiological processes.

(2) Statutory requirements: Product and process inventions are new, involve inventive step and are capable of industrial application. The definition of these terms remains at the discretion of member States.

(4) Rights conferred:

- A product patent confers on its owner the right to prevent third parties without consent from the acts of making, using, offering for sale, selling or importing for these purposes that product.
- A process patent confers its owner the right to prevent third parties without consent from the act of using process and from the acts of using, offering for sale, selling, or importing for these purposes at least the product obtained directly by that process.

(5) The term of protection: Duration of patent protection must last at least 20 years from a filing date of a patent application.

(6) Exceptions to rights conferred and other use without authorisation of the right holder:

Member States may provide for limited exceptions to the rights afforded by patents, provided that such exceptions do not unreasonably prejudice the legitimate interests of the patent holder, taking account of the legitimate interests of third parties.

Appendix 4/3

Patent protection in Thailand

Background

Prior to the 1979 Patents Act, there was no specific legal protection for inventions. Section 272(1) of the Penal Code (Criminal Code) and the Civil and Commercial Code provide some legal protection for invention, but it is considered inadequate.[42] The Patents Act was introduced in 1979 after a long history of unsuccessful attempts. The aim of the Act, as indicated in its preamble, is to fulfil its economic function, namely to encourage invention and innovation. The Act has not entirely achieved its aims because local industries still rely upon imported technology. However, the protection seemed to be beneficial to foreign firms as evidenced by the increase in their patent applications. Furthermore the Act was criticised by the US for not providing adequate protection and the enforcement was weak. The law barred a number of inventions from patentability, for example, food, beverages, pharmaceuticals or pharmaceutical ingredients, machinery for direct use in agriculture, varieties of animals and plants or biological processes for the production of animals or plants, and computer programmes. As a result of political pressure from the US, the Thai patent law was revised in 1992. The new law shows a number of improvements, including the longer patent term and the expanded scope of statutory subject matter.[43]

---

[42] For example, the protection under the Penal Code does not cover the use or the production of products identical to others' products.

[43] The new law extends protection for pharmaceuticals and their active ingredients, food, beverages, agricultural machinery, and biotechnological inventions which were unpatentable under the previous law.

During the first fifteen years since the introduction of patent law, 21,448 applications have been filed and the applications have increased considerably. Despite the impressive number of the applications, patent law does not encourage local inventions. Only 5.28 per cent of the applications have been filed by Thai inventors. The law offers the opportunity for foreigners to gain benefit from the protection by providing that an inventor who holds Thai nationality or a national of a country which allows Thai nationals to apply for patents can file a patent application in Thailand.[44]

Although patent law has been in force in Thailand for nearly two decades, the Thai Patent Office still faces problems due to a lack of technically qualified staff; a backlog of work from previous years; a lack of equipment and search tools for information retrieved; storage shortcomings; and the utilisation of several classification systems for the documentation and search activities.[45]

Additionally, inventors and patent agents face certain difficulties which include lack of adequate knowledge of a patent system;[46] lack of adequate knowledge and skill in the preparation of an application;[47] and financial problems.[48]

---

[44]Section 14 of the 1992 Thai Patents Act.

[45]Kusardy, R. "The Need for a Regional Patent Organisation in South-East Asia" [1985] 7 World Patent Information 264, at 266.

[46]For example, many applications filed by local inventors are widely known or disclosed in any publication before a filing date. Without an understanding of the concept of absolute novelty, an applicant misunderstands that he is entitled to a patent since he has made an invention.

[47]The preparation of an application requires not only technical knowledge but also legal skill. Most local applicants do not have sufficient knowledge and skill. Even though an inventor may employ a patent agent to prepare an application, the inventor, especially from a small company, may not bear the cost.

[48]A patent is not granted free of charge. Besides the prescribed fees such as filing fee, publication fee and examination fee, an applicant has to pay for other expenses in preparing his application and in handling it. These expenses are considerable.

As Thai patent law is relatively young, interpretation and enforcement have not been well developed through case law and administrative decisions. Interpretation is largely based on that developed in countries such as the US and UK. Especially in the field of biotechnology patents, which require a great deal of understanding of law and sophisticated technology, its interpretation and enforcement await detailed clarification.

CHAPTER 5

PLANT BREEDING AND SEED PRODUCTION IN THAILAND: THEIR CURRENT STATUS AND FUTURE

Introduction

The policy underlying PVR law, as discussed in Chapter 2, is to encourage development in plant breeding by protecting plant breeders' interests. Whether the law will play its intended role depends on many factors, including the current status of plant breeding and seed production, which has been the focus of several studies.[1]

The prime aim of this thesis is to investigate the benefits of the forthcoming introduction of PVR legislation in Thailand, in particular whether it will promote the economic interests of the country. What, then, are the major economic interests of the country with regard to plant breeding and seed production? The answer to this question requires a wide-ranging analysis and, for that reason, this chapter will offer a broad economic and technological perspective of the country. The chapter will cover:

(1) The present economy of the country;

(2) Thai agricultural production and marketing;

(3) Plant breeding and seed production in Thailand; and

(4) The current status of plant biotechnology in Thailand.

Despite the emphasis on Thailand's main economic interests, it is necessary in this chapter to look at other relevant information, such as capability of local

---

[1]See, for example, *Plant Breeders' Rights: Report of the Committee on Transactions in Seeds*, Cmnd. 1092, HMSO, London, 1960.

scientists to examine a plant variety for distinctness, uniformity and stability, the so-called DUS criteria.

5.1. Thailand: one of five tigers

Situated in South-east Asia, Thailand is a country with plentiful natural resources, including water, arable land, animals and plants.[2] Due to an abundance of natural resources, the country's economy has long been based on agriculture. The Thai government, however, has recently been making efforts to promote industrial development and diversification based on a relatively open trade and investment environment, competitive private enterprise, and fiscal and monetary restraint. The economic basis has, as a result of these efforts, been radically transformed from agricultural to manufacturing industry, and until 1997, it was one of the world's fastest growing economies. The country was considered to be one of Asia's "five tigers" (Thailand, Taiwan, South Korea, Malaysia and Singapore). The average annual growth of real Gross Domestic Product (GDP) during 1987-1990 was 11.2 per cent which was relatively high, compared to that of other countries.[3] The average growth of GDP in industrial sectors was 15.55 per cent and in agricultural sectors was 3.7 per cent. The contribution of agriculture to GDP declined from 27 per cent in 1970 to 14 per cent in 1992. Nevertheless, since 1993 the share of agriculture in GDP is increasing, albeit slowly. Despite the decline in the economic importance of agriculture in the last decade, agriculture continues to be a dominant force in socio-economic terms, providing employment for a large

---

[2]Thailand is located in the middle of the Indochinese peninsula. The total area is 513,115 kilometres^2 which is approximately the same size as Texas. The country is divided into four geological domains with different natural resources and economic development: the fold belt of mountains in the north; west and south of the country; the fold belt of mountains east of the Chao Phraya Plain, the Korat Plain (Northeast Plateau); and the Chao Phraya alluvial plain. The country has principally a rain-fed agriculture; therefore the main growing season is in the monsoon season. (May to October).

[3]Average GDP is 9.4 % in Korea and Singapore, 7.6% in China, 6.6% in Hong Kong, 8.1% in Malaysia, 5.9% in Indonesia, and 4.8% in the Philippines.

part of the country's work force. Most of the Thailand's industries are still either directly or indirectly agricultural resource-based, for example, agro-processing and textiles.[4]

Economic growth in 1994 was 8.4 per cent which was higher than predicted and economic growth in 1995 reached 8.7 per cent (higher than the UK's economic growth which was 3.2 per cent). In 1996 the economy slowed down to 6.7 per cent as a consequence of potential instability of the government. In 1997 Thailand encountered an economic crisis,[5] namely the devaluation of the Thai currency. The crisis has brought about many problems, such as the fluctuation of currency value and governmental budgetary restraint. These problems will have a long term effect on economic development.

It is expected, notwithstanding the recent economic turmoil in the country, that Thailand will achieve Newly Industrialised Country (NIC)[6] status early in the next century. The rapid economic growth rate, before the downturn, was due mainly to an increase in exports and foreign investment in Thailand which have resulted from the open nature of society and economy, an advantage in raw materials and labour, a fast-upgrading infrastructure and higher compulsory education. However, the 1997 economic crisis and the accompanying political instability create an unfavourable environment for investment in Thailand.

---

[4]*Thailand National Report to the United Nations Conference on Environment and Development (UNCED)*, June 1992, p. 14.

[5]Hereafter referred to as the 1997 economic crisis.

[6]The industrial development is considered by most economists as essential for economic growth and prosperity. Newly industrialised countries (NICs) are countries where their economies increasingly rely on industry. But industrial development in NICs are still far behind the development in advanced industrialised countries (AICs) such as Japan and the UK. Amongst NICs, are, for instance, Thailand, Brazil, Argentina and India.

Many foreign investors are delaying investment projects in Thailand until the economic signs look more auspicious.

5.1.1. Thailand's exports

In the past decade, the increase in exports, especially agricultural products, has been very impressive. From 1987-1991 Thai exports increased in value by 143 per cent, with the United States as Thailand's largest agricultural export market. In 1991 agricultural exports to the US market totalled £323.75 million, of which 37 per cent was fruit and vegetables, 21 per cent was grains and animal feeds, 17 per cent was rubber, and 7 per cent was coffee.[7] The Department of Commercial Economy revealed that during the first half year of 1995 the value of total exports amounted to £15,500 million. The Ministry of Commerce had targeted the country's export growth in 1997 at 10 per cent though whether that was attained remains to be seen. The growing export value resulted from an increase in the prices of certain agricultural commodities, including rice, rubber and sugar. Despite the 1997 economic crisis, it has been suggested that Thailand's export growth should not be affected; on the contrary the weaker Thai currency is seen as beneficial to exports.[8] Agricultural commodities, in particular, are the main beneficiary because such exports contain almost no import content.

---

[7]This information is from the Thai Seventh National Economic and Social Development Plan (1991-1996).

[8]Mr Ruggiero, the director-general of the World Trade Organisation, projects that devaluations of Asian currencies would increase exports from the region. (*Guardian*, Saturday 17th January 1998, p. 26.)

5.1.2. Foreign investment in Thailand

Foreign investment[9] has been given top priority in many of Thailand's National Social and Economic Development Plans as it is a key to Thailand's economic development.[10] It has been confirmed that foreign investment has a significantly positive effect on the rate of economic growth in Thailand.[11] The country was

---

[9]Foreign investment refers to an investment involving a long-term relationship and reflecting a lasting interest and control of a resident entity in one economy (foreign investors or parent enterprise) in an enterprise resident in an economy other than that of the foreign investor. It implies that the investor exerts a significant degree of influence on the management of the enterprise resident in the other economy. (*World Investment Report 1996: Investment, Trade and International Policy Arrangement,* United Nations Conference on Trade and Development, United Nations, Geneva, 1996, p. 219.)

[10]Lal concludes the benefits of foreign investment in developing countries: "...First, and most importantly, in developing countries with surplus labour and a saving constraint, there is the direct benefit given by the difference between the wages actually paid to the local labour employed by the foreign firm, and the social opportunity cost of this labour to the host country. Secondly, and equally importantly, are the implicit and explicit taxes paid by the foreign investor to the host country. Thirdly, and more debatably, there are the effects due to the technical progress (widely conceived to include the introduction of better management and marketing techniques, the implanting of new skills, as well as the introduction of new technology) ... Finally, there are the benefits given by the present value of the net capital inflow ... over the lifetime of the investment." (Lal, D. *Appraising Foreign Investment in Developing Countries,* Heinemann, London, 1975, p. 30.)

The benefits and costs of foreign investment have been a matter of fierce controversy. Some commentators point out the benefits, including transferring technology to host countries, expanding trade, creating jobs and speeding economic development and integration into global markets. Some fear that foreign would have undesirable consequences, such as permitting exploitation of host country's market, and in general reducing host country's ability to manage its economy. (World Trade Organisation, *Trade and Foreign Direct Investment,* Press/57, Geneva, 9th October 1996, p. 23)

[11]Husain, I. et al. *Capital Flows to South Asian and ASEAN Countries,* International Economics Department, World Bank, Washington DC, 1992, p. 16.

one of the main recipients of foreign investment.[12] The principal attractions of Thailand for foreign investment include cheap labour, abundant natural resources, profitable market(s) and the government's policy. The government's policy of encouraging foreign investment is illustrated by several measures. The Investment Promotion Act of 1977, which is administered by the Board of Investment (BOI), is a good example, aiming to promote both domestic and foreign investment. The BOI has introduced a wide range of investment incentives to attract potential investors whose projects meet any of the following criteria: significantly strengthen Thailand's balance of payments[13] position, especially through production for export; support the development of the country's resources; substantially increase employment; locate operations in rural areas; conserve energy or replace imported energy supplies; establish or develop industries which are fundamental to industrial development.

---

[12]Foreign investment has been heavily concentrated amongst a small number of countries. 90 per cent of foreign investment inflows to developing countries in 1990 was received by only 18 countries and half of this total flowed to 8 Pacific Basin developing market economies (Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan and Thailand). (Fry, M.J. *Foreign Direct Investment in a Macroeconomic Framework: Finance, Efficiency, Incentives, and Distortions,* International Economics Department, World Bank, Washington DC, 1993, p. 4.)

[13]Balance of payments is a comprehensive set of accounts recording a country's transactions with other countries and with international organisations. It can be divided into two parts: the current account and the capital account. The current account is composed of visible trade (the import and export of tangible goods) and invisible trade (services such as banking, insurance and tourism). The capital account deals with the flow of funds out of and into the country through investment abroad and internal investment by foreign countries and organisations. If the balance of payments is persistently in deficit or in surplus the exchange rate of the country's currency will be liable to fall or rise accordingly. (Leibster, L. et al. *The Hamlyn Dictionary of Business Terms,* Hamlyn, London, 1989, p. 21.)

Table 5.1 Foreign investment inflow in Thailand[14]

Year	1990	1991	1992	1993	1994[15]	1995
$ Million	2444	2014	2116	1726	640	2300

In sum, the country's economic development mainly relies on exports and foreign investment. Many multinationals have relocated their manufacturing to Thailand in order to take advantage of low costs of labour and materials. Nevertheless, Thailand has recently faced steep competition from neighbouring countries, such as Vietnam and Indonesia.

Despite impressive economic development in recent years, Thailand is still regarded by the General Assembly of the United Nations and the World Bank as a developing country. This status may be seen to be beneficial to the country in certain respects, including financial aid from other countries and international organisations, and privileges conferred by international conventions or treaties.[16]

5.2. The structure of Thai agriculture and its market

As discussed earlier, agricultural sectors still make an important contribution to Thailand's economic development in terms of both export and employment. The following paragraphs offer an overview of Thai agriculture and its market.

---

[14]This information is based on *World Investment Report 1996: Investment, Trade and International Policy Arrangements,* United Nations Conference on Trade and Development, United Nations, Geneva, 1996, p. 230.

[15]A sharp decrease in foreign investment inflow resulted from political instability.

[16]See, for example, the "Transitional Arrangement" provision under Article 65 of the Agreement on Trade-Related Aspects of Intellectual Property Rights. See Chapter 3 for more details.

5.2.1. Agricultural production

Most of Thailand's agricultural areas are concentrated in the central part of the country, especially those surrounding the Chao Phraya river which is the main river serving extensive irrigation. Major agricultural products include rice, cotton, cassava, and vegetables. Since the country is geographically divided into various regions, different plant species grow in different areas, depending on weather and soil. Rice and most field crops can grow in every region whilst specific crops grow in certain regions: Northeast for cassava, maize, kenaf and mulberry; West for sugar cane; North for sub-tropical and temperate fruits and vegetables, flowers and fruits, soybeans and maize; East for fruit trees, cassava and rubber; South for fruit trees, rubber and oil palm.

Table 5.2 Climatic zones for seed production[17]

Plants	Climatic zones
Field crops	They are produced throughout the country.
Vegetables	Vegetable seed is produced mainly in the north, northeast and central areas.
Pasture seed	Most pasture crop seed is produced in the northeast. Small amounts, such as *B. ruziensis*, are produced in the north, central and upper south.
Ornamental plants	Most are produced in the north and northeast.
Forestry	Tree seed is produced under the Royal Forestry Department's replanting programme.

According to the Agricultural Development Plan under the Seventh National Economic and Social Development Plan (1992-1996), the government targeted for the agricultural sector an average growth rate of 3.4 per cent. At this rate of expansion, more intensive application of higher agricultural technology is necessary to boost productivity. Modern technology such as biotechnology is anticipated to play a vital role in agricultural development, particularly plant

---

[17]This information is based on information from the Thai Department of Agricultural Extension.

breeding. The Seventh National Plan provides that the government would encourage agricultural development by emphasising enhancement of productivity and higher value added products. Modern farming techniques and quality seed would be introduced to farmers.

5.2.2. Agricultural market(s)

Thailand's agricultural products are marketed locally and internationally. It is expected that the numbers of both local and international markets for Thai agricultural products will rise in the near future. Local consumption has been increasing as a result of rapid population growth and the increasing use of agricultural products in local agro-industries. Thailand's population was reported as 60 million at the end of 1996. In recent years, the country has witnessed the rapid development of agro-industries, e.g. food and textile industries; this resulted from many factors, such as an abundance of natural resources and the government's support. International markets of Thai agricultural products have a bright future. Agriculture is amongst the top ten Thai exports in terms of value because the world's major producers have suffered natural disasters.[18] Thailand is the world leading exporter of many agricultural products, such as rice, rubber and orchids. Furthermore, it is believed that trade liberalisation under the WTO agreement will expand international markets for Thai agricultural exports.[19] Accordingly, the government is confident that the future of agricultural markets is promising and therefore agricultural sectors will have to increase their production in order to respond to the anticipated growing demand for raw materials, e.g. seed.

---

[18]*The Nation*, 6th January 1997.

[19]See Chapter 3 for more details.

Whilst a wide array of plant species can be cultivated in Thailand, not all of these species are important for the Thai economy. For instance, many vine species have been grown in the northern part of the country; yet the use of their products (fruits) is limited because wine making in Thailand is on a small scale. The Thai government will determine therefore which plant species should be eligible for PVR protection. Priority should be given to species with (potential) economic importance, such as rice, corn, cassava, orchid, rubber and palm.

5.3. Plant breeding and seed production in Thailand

5.3.1. The current status of plant breeding in Thailand

The Department of Agriculture is the first and major research institute for plant breeding in Thailand. A large number of plant varieties have been developed by Rice Research Division, Field Crop Research Institute, Horticulture Research Institute and national network of research stations. These varieties have been widely released to the public: up to 1994, the Department of Agriculture has released 113 varieties, including 48 field crop varieties, 11 horticultural varieties, 30 rice varieties, 10 temperate cereal varieties, 8 sericultural varieties, 2 mulberry varieties and 4 rubber varieties.

Universities and other public research institutes are also engaged in plant breeding activities. Success in the development of hybrid corn varieties and plant tissue culture of orchids, mainly at Kasetsart University, prompted active research in using both conventional breeding and new plant biotechnology techniques to improve the varieties of grain crops, fruits and flowers. The private sector has, of late, become more interested in plant breeding activities. Most major international seed producers have launched research projects ranging from plant breeding to seed production of grain crop and vegetable

varieties. At the same time, the number of tissue culture laboratories in both private and public sectors has increased to 18, second in Asia only to Japan.[20]

Table 5.3 Some plant varieties developed by the Department of Agriculture

Plant	Developed variety
1. Rice 1.1. Farming rice 1.1.1. Rice	Kowdogmali 105, Numsakui 19, Nangmon S-4, Kowtahang 17, Kowpakmor 148, Leungpratew 123, Leungyai 148, Nangpaya 132, Rice Division Variety 7 (R.D. 7), R.D. 13, R.D. 15, R.D. 21, R.D. 23, R.D. 25, R.D. 27, Kanjun, Patumtani 60, Suphanburi 60, Chumpae 60, Pattalung 60, Huntra 60, Phitsanulok 60-1, Phitsanulok 60-2, Suphanburi 90, Chainat 1
1.1.2. Glutinous rice	Hangyee 71, Sanpatong, R.D. 6, R.D. 10, Meuynong 62M
1.2. Upland rice	Jaohor, Numru, Dokpayom, Kumeangluang
1.2.1. Rice	Silmaejun, R258, Kaewpongkrai
1.2.2. Glutinous rice	Lepmeunang 111, Tapalkeaw 161, Pinkeaw 56, R.D. 17, R.D. 19, Huntra 60
1.3. Floating rice	
1.3.1. Rice	Nangchalong
1.3.2. Glutinous	
2. Wheat	Sameung 1, Sameung 2, Fang 60, Prae 60
3. Barley	Sameung 1, Sameung 2
4. Corn	Nakornsawan 60, Chaing Mai 60, Rangsit baby corn 1
5. Sorghum	Suphanburi 60, Uthong 1
6. Soybean	Nakornsawan 1, Sukhothai 1, Chaing Mai 60, Mai-jo University 1 (S.J. 1), S.J. 2, S.J. 4, S.J. 5
7. Mungbean	Chainat 60, Uthong 1, Uthong 2
8. Groundnut	Thainan 9, Khon Kean 60-1, Khon Kean 60-2, Khon Kean 60-3, Uthong 1
9. Cassava	Rayong 1, Rayong 2, Rayong 3, Rayong 60
10. Sesame 10.1. White sesame 10.2. Red sesame	 Mahasarakam 60 Ubolrachatani 1
11. Jute	Khon Kean 60
12. Potato	Fang 60
13. Coconut	Chumporn hybrid 60
14. Cashew nut	Srisaket 60-1 (S.K. 60-1), S.K. 60-2
15. Rubber plant	Songkla 36
16. White mulberry	Nakornrachasima hybrid 60, Burirum hybrid 60

---

[20][1992] 9 Asean Journal on Science & Technology for Development 1, at 8.

5.3.2. Main developmental problem(s) of plant breeding in Thailand

Even though Thailand is one of the major world agricultural producers and a number of research institutes are active in plant breeding activities, the development of plant breeding is still far behind many developed countries. The main constraints on the development of plant breeding in both public and private sectors are insufficient investment, shortage of trained staff, and in the private sector a lack of interest in research and development.

(1) Budgetary constraints. Even though the government has injected a large amount of investment in research and development relating to plant breeding, the allocated budget is still insufficient to boost the country's technological development. The government has long been hampered by insufficient income. Budgetary constraints also result in shortage of facilities which deters development.

(2) Shortage of trained staff. This is a problem which has long resulted from:

-Under-emphasis of science and technology. In the past the government emphasised the importance of economic development, ignoring the importance of science and technology. Limited budgets were allocated to science and technology activities.

-Lack of training facilities. The present education and training programmes concentrate on traditional areas of science, agriculture and medicine with little capacity for production of manpower in modern technology, such as biotechnology. Very few Thai universities are capable of producing researchers who are well trained in conducting plant breeding (particularly, modern breeding programmes with the application of new biotechnological techniques).

-Lack of incentive in the public sector. The salary for government staff is very low; for instance, salaries for science graduates are only half (or less) than

those paid in private sectors. Moreover, many science graduates decide to work in other areas where they can earn more money.

The main problem in the private sector is a general lack of interest in technical research and development. Most private-sector R&D comprises mainly in-house improvements to the operation of process and quality control of products, as distinct from product development. In the past, the seed business (run by multinational companies) relied on imported parental lines, but this is changing. Recently these multinationals have begun to conduct R&D locally because of the increasing number of trained staff.

The main problem - little or no plant breeding in Thailand - was not due, as in some developing countries, to the absence of PVR protection. It resulted from the lack of interest of the government and industries in research and development in the past. However, some problems, e.g. the shortage of trained staff, are being alleviated by current government policy which aims to promote science and technology.

5.3.3. The future direction of plant breeding activities in Thailand

To keep pace with the transformation of Thailand' s economy, plant breeders in both public and private sectors have to develop new varieties with improved quality and productivity. Plant breeders should consider certain factors which influence the direction of plant breeding.

(1) New varieties (their products) must be suitable for export in terms of foreign consumer behaviour and transportation, that is to say, they must be able to travel and to attract foreign customers. A product which is popular in one country is not necessarily popular in other countries. The story of Thai Jasmine

rice is a fine example. The rice is very popular in the local market; however, it was rejected by Japanese customers because they did not like the odour.

(2) New varieties must be suitable for agro-industrial production.[21] Thailand is one of the world's leading manufacturers of agro-industrial products, e.g. canned fruits. Agricultural products used for agro-industrial production must possess certain qualities, including uniformity. At present most manufacturers of canned pineapple in Thailand employ farmers to grow pineapple for processing.

(3) New varieties must be suitable for intensive agricultural practice as a result of a decrease in agricultural lands which results from many factors, including:

3.1. The country is expected to lose its agricultural lands, as roads, factories, estate property and golf courses spread across the countryside.

3.2. Environmental changes. Global warming, climate changes, shortage of natural resources, such as water.

Business executives of Thai seed industries believe that the above factors are of great significance to the future direction of plant breeding.

5.3.4. The current status of seed production in Thailand

In the past, most seed production and distribution was carried out by the government, particularly for major crops, including cassava, corn, cotton, groundnut, kenaf, rice, sorghum, soybean and sugarcane. Because the government's production facilities could not serve the demand, the private

---

[21]Also see "The YUP Bias" or " Breeding for Yield, Uniformity and Processing" in Mooney, P.R. *Seeds of the Earth: A Private or Public Resource?*, Canadian Council for International Co-operation, Ottawa, Canada, 1979, p. 82.

sector is being encouraged to engage in seed production. Basically, seed production (both in private and public sectors) in Thailand is based on the limited generation certification system proposed by the International Seed Testing Association (ISTA).[22] In this system seed is produced in four steps: breeder's seed, foundation seed, registered seed and certified seed. In most cases, the steps of registered and certified seed are incorporated into one class of extension seed. Certified or extension seed is distributed to farmers by various channels.

Seed production in public facilities is the responsibility of the Seed Division of the Department of Agricultural Extension (DOAE). The Department of Agriculture (DOA) carries out plant breeding activities and foundation seed production.[23] The DOA is the only producer of all cereal foundation seed in the

---

[22]Sittisuang, P. "Structure and Nature of the Seed and Plant Breeding Industries and Regulatory Arrangements of the Seed Industry in Thailand"; presented in *Seminar on the Nature of and Rationale for the Protection of Plant Varieties under the UPOV Convention*, organised by the International Union for the Protection of New Varieties of Plants in cooperation with the Government of Japan, Tsukuba, Japan, 12th-15th November 1991.

[23]Policy and responsibilities of the Seed Department.

Policy:

(1) To multiply high quality seed of the varieties genetically improved by the Department of Agriculture and other research centres. These improved seeds are used mainly for the government promotion and natural-disaster relief programmes as well as for individual sales.

(2) To promote farmer use of quality and improved seeds in order to increase their income.

(3) To increase an efficiency of industrial scale production and marketing.

(4) To encourage participation of farmers, farmer institutions, and private sector in production of quality, improved seeds for local use and export.

Responsibilities:

(1) To produce and distribute improved seeds of major economic-important crops which are technically developed by recognised institutions, and to secure a supply for farmer demand through the government complementary programmes.

(2) To develop industrial scale seed production, to make estimation and analysis of seed requirement and marketing situation.

country (except some open-pollinated and synthetic maize varieties which are also produced by Kasetsart University). The Seed Division plans and implements the production of extension seed through its local seed processing centres. The first seed centre was established in 1974 in the province of Pitsanulok and since that time 23 seed centres with over 400 staff have been set up in various regions of the country. Each centre carries out a full range of activities, including seed multiplication, marketing and after-sale service. The Seed Division also ensures that farmers benefit from research by the availability of pure seed. It supplies only a small proportion of seed and demonstrates that seed supply operations can be profitable for seedsmen and farmers. Extension seed is sold to farmers at relatively low or subsidised cost. The Division has been careful to avoid any competition with the private sector, playing a complementary role by engaging in seed production where the production and distribution is normally unprofitable (industries are not interested in this business).[24] However, the Division may produce seed (which is normally produced by industries) in the case of seed shortage in the market.

---

(3) To serve as a Centre for Seed Technology, to provide technical training for the Department of Agricultural Extension staff, students and farmers who are interested in production of quality seeds.

(4) To render services on laboratory seed testing and analysis to related government agencies and the public.

(5) To stimulate the extensive use of quality seed to raise the farmers' income.

(6) To enhance the exchange of technical knowledge and attitude on many aspects of seed operation with local and foreign organisations.

(7) To seek technical cooperation and assistance with regard to seed production from national and international institutions.

(8) To provide information on seed and undated seedstock to concerned government agencies and individual farmers in favour of marketing promotion.

(*Seed Division Report*, Department of Agricultural Extension, Thailand, 1993)

[24]The Division has determined that certain crops, such as rice and corn, need state subsidy for seed development, production and distribution, mainly due to the fact that most small farmers depend on these crops for their livelihood.

Table 5.4 The quantities of seed supplied by the Seed Division during 1990-1993 (tonnes)[25]

Variety	1990	1991	1992	1993
Rice	13,194	21,224	24,684	24,502
Maize	2,223	2,650	2,439	554
Sorghum	27	15	57	18
Mungbean	1,493	1,856	1,640	3,161
Soybean	4,344	4,628	5,064	6,638
Peanut	1,727	2,035	1,769	1,676
Cotton	130	195	201	160
Kenaf	39	187	39	80
Sesame	160	93	89	22
Wheat	62	88	77	155
Vegetable	61	66	99	105
Total	24,180	33,037	36,158	37,071

At present, Thailand's seed private sector comprises medium and large companies. There are currently over 100 companies registered to import seed, to engage in local seed production and commercialisation, and registered as exporters. Despite the number of seed firms, private seed production is dominated by a few multinationals (yet the largest seed company is a local firm "Charoen Pokphan Group"[26]) with the main strategy of importing parental lines developed abroad for bulk production in Thailand, exploiting the advantages of the ready availability of land and cheap labour. The technology embedded in these parental lines is not accessible to local staff who are mainly occupied with adaptive research for yield improvement through traditional breeding and

---

[25]This information is from Seed Division, Department of Agricultural Extension, Thailand, 1994.

[26]The main reason for the success of CP Group is the understanding of the local market. The firm manufactures a wide range of products, including fertiliser, feed and pesticide. Product distribution is very effective; the company employs a number of salesmen who visit customers (either shops or farmers) throughout the country.

agronomic manipulations. Nevertheless this trend has been changing recently and some firms have developed parental lines locally.

Table 5.5 Major seed firms in Thailand[27]

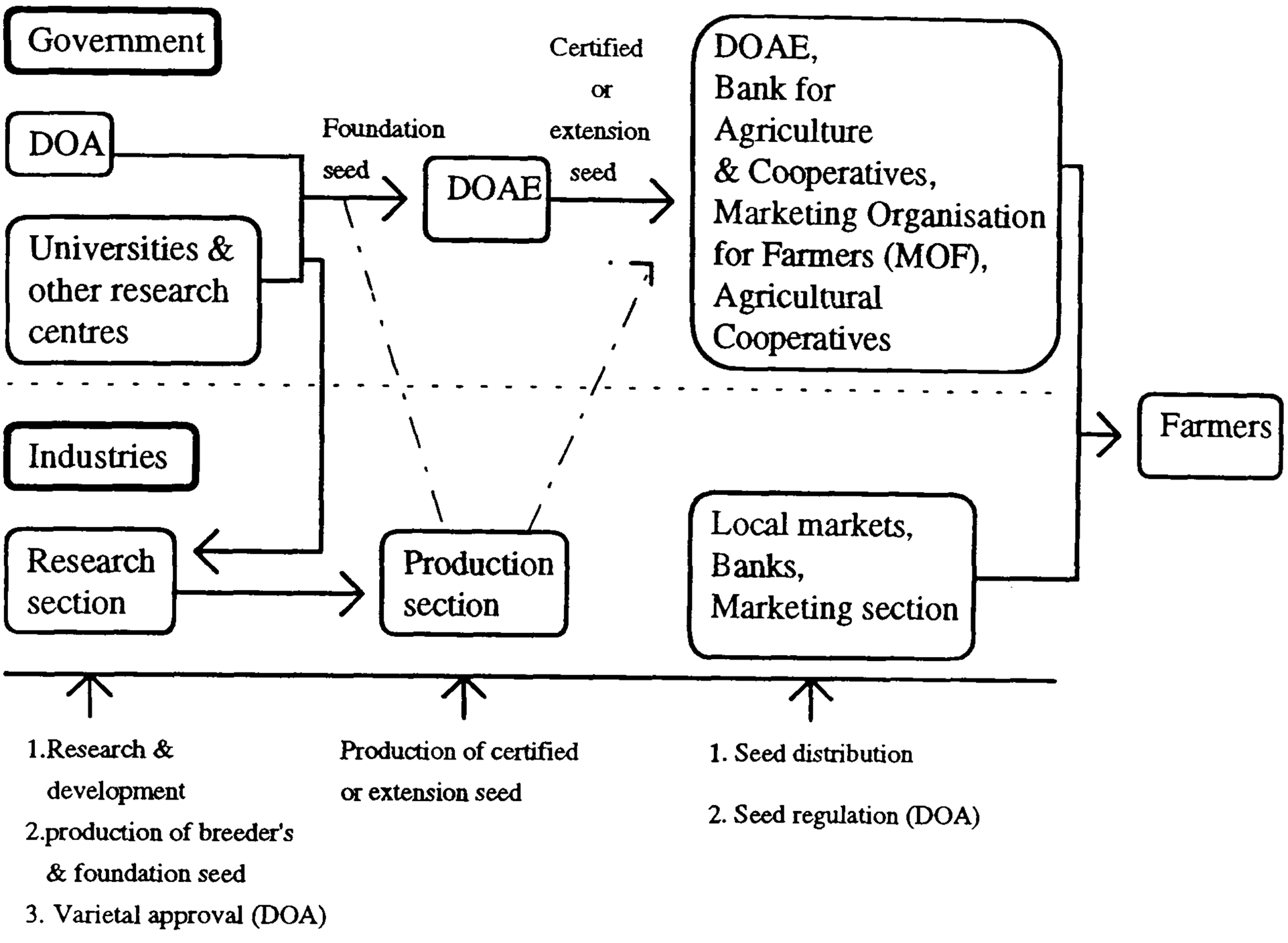
Company	Technology partner	Vegetable	Corn	Sorghum	Soybean	Other
Chia Tai	Various	x				
Pacific Seeds	Zeneca		x	x		x
Charoen Pokphand	Dekalb		x	x	x	x
Cargill	Own		x	x		
Pioneer	Own		x	x		
Ciba Geigy	Own		x	x		
Uniseeds	Own		x	x	x	x
East West	Own	x				
Known You	Own	x				
Asgrow	Upjohn	x				
Adam International	Petoseed	x				
Hsin Seed	Own	x				

All major companies have their own research and processing facilities in the country and most of the companies produce seed by contracting local farmers. Thai farmers are expert in contract seed production, and this brings considerable income into many areas of the country. These companies use similar marketing channels, notably via distributors, dealers and sub-dealers.

---

[27]This information is from Thomson, P. *Trend in Thailand's Seed Sector*, Paper presented at ASIAN SEED'94, Chiang Mai, Thailand, September 1994.

Fig 5.1 Seed production and distribution in Thailand



5.3.5. Seed industry in Thailand

5.3.5.1. Historical development of Thailand's seed industries

The Thai seed industry has its grassroots in the business of importing and marketing which started in the 1920s when the private sector in the main fresh vegetable market of Pak Klong Talad imported and marketed vegetable seed. However, seed of other varieties, e.g. crops, were not popular amongst farmers since they preferred to keep harvested grains as propagating material for the following season. It was not until the first release of a hybrid corn "Suwan 1" by Kasetsart University in 1975 that the first private field crop companies were established under Board of Investment promotion to produce and distribute corn seed on a large scale. The business has proven very successful and its success has attracted other companies to set up business in seed production.

This situation can be viewed as the first wave of seed industry development in Thailand. The second wave of the development commenced between the late 1970s and early 1980s when many multinational companies saw opportunities to bring germplasm and seed technology to produce seed in Thailand for domestic and export markets. These firms have played a vital role in seed development in bringing to the country a number of new varieties and production techniques.[28] The success of the seed market is mainly due to the government policy to promote the use of quality seed, particularly hybrid seed.

5.3.5.2. The current status of investment in seed production in Thailand

Seed production requires considerable investment and complicated technology. It was estimated in 1994 that the value of the vegetable seed industries in Thailand amounted to £8.75 million and the total value of the field crop and vegetable seed industries was approximately £105.3 million.[29] Investment in seed production in Thailand comes from both public and private sectors. Public investment is very limited because of government budgetary constraint; therefore, the government has to encourage private investment. Private investment is mainly made by multinationals since local investment is limited. The scarcity of local investment led the government to consider foreign investment as a major contribution to Thailand's economic development because it adds to inadequate supplies of local capital, managerial and technical skills. On many occasions multinational seed firms have been able to use their technical and financial strengths to start new activities in Thailand which appear

---

[28]These can be evidenced by the introduction of hybrid tomato seed by Adam International, hybrid corn by Pacific and hybrid melon by Know You.

[29]Thomson, P. *Trends in Thailand's Seed Sector*, Paper presented at ASIAN SEED' 94. Chiang Mai, Thailand, 27th-29th September 1994, p. 53.

too risky and costly for local investors.[30] The Thai government has a clear policy of encouraging foreign investment.[31]

5.3.5.3. Technological capability of Thai seed industries

In 1988, the Thai National Centre for Genetic Engineering and Biotechnology conducted a survey "The Development of Thailand's Technological Capability in Industry".[32] Technological capability in the seed industry is summarised in the following table.[33]

---

[30]Thomson, P. *Trends in Thailand's Seed Sector,* Paper presented at ASIAN SEED' 94, Chiang Mai, Thailand, 27th-29th September 1994, p. 48.

[31]A policy of encouraging foreign investment has been part of the previous and present Thailand's National Economic and Social Development Plans. The government makes no distinction between local and foreign firms, except by specifying under the Alien Business Law and the Alien Occupation Law the sectors and occupations that foreigners cannot engage in. The government only screen foreign investment proposals that seek promotional privileges from Thailand's Board of Investment (BOI). Special consideration is given to projects that contribute to the balance of payments, resource and regional development, energy conservation, employment and technology transfer. (Lim, L.Y.C. et al. *Foreign Direct Investment and Industrialisation in Malaysia, Singapore, Taiwan and Thailand,* Development Centre of the Organisation for Economic Co-operation and Development, Paris, 1991, p. 47) Seed industries have been granted BOI promotional privileges.

[32]40 firms were selected from 8 biotechnology sectors; namely aquaculture industry, feed industry, seed industry, dairy industry, flower industry, organic acid industry, alcohol industry and health industry.

[33]This rating is interpreted as follows:

5 = capability level equals that of world frontier firms.

4 = capability level equals the average for firms in industrialised countries.

3 = capability level below the average of firms in industrialised countries but higher than most local firms.

2 = capability level well below the average of industrialised countries but common locally.

1 = capability level below the local norm or no capability.

Table 5.6 Summary of capability ratings for seed industry

Industry	Acquisitive	Operative	Adaptive	Innovative	Average
Seed	3.46	3.70	3.69	2.80	3.41[34]

The study revealed that the capability for development of the Thai seed industry was considerable: it was slightly below the average of firms in industrialised countries but markedly higher than that of local firms. The high level of operative capability revealed that the industry was very active in seeking new technology, assessing various technology options, obtaining favourable transfer terms, buying new technology, completing a successful transfer, and successfully installing new technology. Strengths of adaptive capability in this industry tended to be in the area of product modification and in the ability to acquire new knowledge and apply it to product improvement. Most Thai seed companies have collaborated with foreign organisations, for example Pacific Seeds with Zeneca and Charoen Pokphand with Dekalb. The collaboration ranges from training programmes to a day-to-day contact of international seed companies with their regional affiliates. In 1994, at least 12 major seed companies employed technically-trained, commercially-oriented seedsmen and most are capable of developing their own parental lines locally (these firms include CP/ Dekalb, Pioneer, Ciba Geigy and Pacific Seeds).

---

[34]The average ratings of technological capability in other industries are: 4.02 in aquaculture; 3.71 in feed industry; 3.02 in dairy industry; 2.93 in flower industry; 2.88 in organic acid industry; 2.71 in alcohol industry; and 2.61 in health related industry.

5.3.6. The current status of seed consumption in Thailand

The estimate of public seed production is 20,000 tonnes annually; but there has been no estimate of production by private industry. Yet, the amount of seed imported suggests that seed production cannot meet the needs of the local market, which requires 500,000 tonnes annually. High quality seed has been imported from various countries, including Japan, Taiwan, the Netherlands, and the US. Most imported seed is vegetable seed, e.g. cabbage, morning glory and radish.

Table 5.7 Imported seed used for sowing in 1993[35]

Seed	Quantity (Tonnes)	C.I.F. value (baht)	Countries
Beet seed	236	284,040	Australia, US
Rye grass seed	1,996	561,374	Australia
Other seed of forage plants	3,899	983,568	Australia, Netherlands, US
Seed of herbaceous plants cultivated principally for their flowers	251	1,079,930	Japan, Netherlands, US
Other vegetable seed	2,676,767	251,880,739	Australia, China, Denmark, Hong Kong, Israel, India, Japan, Maldives, Malaysia, New Zealand, Taiwan, US, Republic of Korea, Netherlands, Vietnam
Tobacco seed	121	561,625	France, US, Japan, Netherlands
Flower seed	2,286	1,930,755	Japan, US, Tanzania, New Zealand, Denmark Netherlands
Other seed, fruit and sports	104,853	16,599,194	Australia, China, Japan, Philippine, US, Taiwan France, Rep. of Korea

[35]This information is based on *Foreign Trade Statistics of Thailand 1993*, Thai Customs Department, Ministry of Finance, Thailand, 1993.

Table 5.8 Seed demand in major crops in Thailand in 1993[36]

Crop	Estimated total planting area (x 1000 ha)	Total seed demand (tonnes)
Rice	3,955	298,355
Maize	1,444	31,595
Sorghum	197	3,300
Mungbean	400	10,000
Soybean	409	17,900
Groundnut	91	11,400
Cotton	94	1,500

Table 5.9 The current status of seed demand in Thailand[37]

Seed	The current status
Self-pollinated crops, e.g., rice, jute, soybean, mungbean, and groundnut	The demand for self-pollinated seed is very high; but the supply by both public and private sectors is inadequate. Presently the production in the country is only 4.5 per cent of total demand. Farmers have to rely on seed selected and saved by themselves.
Crossed-pollinated crops or Often crossed-pollinated crops, e.g., maize, castor bean, sorghum, and cotton	Most seed is produced by seed industries, especially maize, sorghum and hybrid castor bean. Farmers produce only open-pollinated seed. Cotton, as a special case, is planted in a limited area so the supply exceeds the demand. Cotton seed is by-products from cotton industries.
Plants which are not propagated by seed, e.g., sugar cane, cassava	Farmers mainly rely on propagating materials produced by themselves. Public institutes can produce only a small amount of propagating materials whilst industries are not interested in this business.
Vegetables and flowers	Vegetable and flower seed is sold with a relatively high price since farmers cannot produce or save this hybrid seed for a following season. Their parental lines are developed abroad and imported to the country; but their hybrid seed is produced in the country. In sum farmers mainly rely on seed produced by industries.

In sum, the local demand for seed outstrips the supply. This offers an opportunity for the private sector to increase its investment in seed production, especially quality seed production. The demand for seed, in particular field crops, is expected to increase for two main reasons:

1. Trade liberalisation under the World Trade Organisation agreement will encourage the agricultural sector to increase their production.

---

[36]This information is from Department of Agricultural Extension, Thailand.

[37]This table is based on information from the Department of Agriculture, Thailand.

2. Farmers are inclined to purchase hybrid seed for its better quality and productivity.[38,39] For example, the use of hybrid maize seed has increased from 1 per cent in 1983 to 35 per cent in 1994 whilst the use of farmer-saved seed has decreased from 95 per cent in 1981 to 23 per cent in 1994. A local agricultural expert has projected that annual seed replacement amounts to 25 per cent. This figure, however, appears to be well above the replacement rate of rice and below that of corn. For vegetable and processing crops, the figure usually goes up to 100 per cent.[40]

The shortage of seed and the profitable market should attract investors to enter the seed business. However, the nature of seed production (which requires considerable investment and complicated technology) may deter some investors from entering this business.

---

[38]Most hybrid seeds introduced at a relatively high price have met an initial resistance to price. However, farmers become repeat customers after they have used these hybrid seeds. According to seed industries, farmers are prepared to pay a substantial premium which is over the price of normal open-pollinated seeds.

[39]Thomson, P. has anticipated that a rising quality seed replacement rate is due to:

(i) advantages of quality seeds;

(ii) an increase in new released varieties;

(iii) demand from agro-industry for specific varieties for processing, or for export and domestic markets;

(iv) active role of the government in distributing seed, particularly under seed-for grain exchange schemes.

(Thomson, P. *Trends in Thailand's Seed Sector*, Paper presented at ASIAN SEED'94, Chiang Mai, Thailand, 27th-29th September 1994, p. 56.)

[40]Thomson, P. *Trends in Thailand's Seed Sector*, Paper presented at ASIAN SEED'94, Chiang Mai, Thailand, 27th-29th September 1994, p. 38.

5.3.7. Regulatory arrangements for plant breeding and seed production in Thailand[41]

Even though the following regulatory arrangements are not part of PVR protection (or not at least intellectual property protection), their potential interaction with PVR protection cannot be ignored.[42]

5.3.7.1. Variety certification

New varieties with improved agronomic characteristics can be submitted for variety certification. The certification is a voluntary system, aiming to promote varieties with improved quality. The Variety Certification Committee under the Department of Agriculture implements this programme. The main statutory requirement for the certification is that new varieties must be tested with respect to their yield and other agronomic characteristics (e.g. disease and insect resistance and fertiliser response) which are superior to those of local and standard varieties which are widely grown by farmers. The test is carried out in various locations for at least 2-3 years.

5.3.7.2. Seed certification

Seed certification in Thailand comes under Section 28 of the 1975 Seed Act (revised in 1992). The system is implemented by the Department of Agriculture. The certification of seed and propagating material in Thailand is voluntary. However, the certification is obligatory for seed produced by

---

[41]See Appendix 5/1 for regulatory arrangement for plant breeding and seed production in Thailand.

[42]See for example the relationship between PVR, National Listing and Seed Certification systems in the UK in Appendix 2/2.

governmental organisations. Seed must meet the standard requirements. including germination rate, purity, moisture content. The certification does not seem to be popular amongst seed companies. Two possible reason are that:

(1) The holder of a seed certificate does not benefit from the legislation; it does not give the holder any form of protection against others who appropriate his variety.

(2) Certification does not boost sales because it does not encourage farmers to purchase certified seed. It seems more likely that farmers are influenced by brand names because they feel confident about the quality of seed produced by well established firms.[43]

5.3.7.3. Regulatory control over the commercialisation of controlled seed

The production and commercialisation of controlled seed[44] is regulated by the 1975 Seed Act (revised in 1992) which is administered by the Seed Regulatory Sub-Division, Agricultural Regulatory Division of the Department of

---

[43]When the author was employed for a year by the Thai Department of Agricultural Extension in 1988, he visited farmers in various regions, particularly Northeast and Central areas and saw that farmers were inclined to buy seeds produced by big companies. In 1993 the author asked approximately 20 farmers in the province of Chai Nat (one of important agricultural areas) whether brand names were important in seed purchasing decisions and most of them confirmed that.

This view is supported by the widespread use of advertising of seeds and other agricultural products on radio "soap operas" in Thailand. These programmes are very popular amongst farming communities. The inevitable conclusion is that advertisers have found farmers to be receptive audiences for seed advertising and that it leads to sales of the branded seeds.

[44]The legislation defines seeds as a wide range of propagating materials, including whole plant, stem, shoot, corm, branch, twig, bud, root, tuber flower, fruit or seed which can be reproduced sexually or asexually.

"Controlled seeds" are seeds of species which are officially notified by the Ministry of Agriculture. Up to now, the Ministry has notified 25 species, including rice, field crop species and vegetables.

Agriculture. The Act aims to ensure sufficient protection for farmers to purchase standard seed by prohibiting the sale of seed of certain species, mainly field crops and several vegetables, if the seed is below the standard established in a Ministerial Regulation. To commercialise this controlled seed, a seed company must be granted a licence from the Regulatory Authority.[45] From time to time, seed inspectors randomly draw samples of seed labelled as controlled seed from the market, and if the samples are found to be sub-standard the vendor may not sell the seed and may be punished a fine and imprisonment. The Seed Act can be seen as the legislation for seed users and propagators; it does not give a license holder protection where others commercialise seed of similar varieties. So far the effectiveness of the legislation has not been assessed.

5.4. Plant biotechnology: a new hope for development of plant varieties in Thailand

Thai experts have predicted that modern biotechnology will play a vital role in the country's economic development.[46] Biotechnology-based industry has made a major contribution to the country's income. Thailand is currently the world leader in the export of many products, e.g. rice (nearly £ 0.75 billion exported in 1992) and canned pineapple (nearly £ 0.14 billion in 1992). The application of biotechnology can give rise directly to various marketable products,

---

[45]Section 17 provides that there are five types of license for controlled seed as follows:

(1) license for aggregating controlled seed for trade.

(2) license for selling controlled seed.

(3) license for importing controlled seed for trade.

(4) license for exporting controlled seed for trade.

(5) license for shipping controlled seed in transit for trade.

[46]One of these experts is the Director of the National Centre for Genetic Engineering and Biotechnology (Dr. Sakarindr Bhumiratana).

including plant propagules (e.g. seed), and in some cases, it is a facilitating activity leading to reduced production costs (e.g. higher yield plant varieties) or lower losses from disease and stress.

5.4.1. Current status of plant biotechnology in Thailand

It was not until the establishment of the National Centre for Genetic Engineering and Biotechnology (NCGEB) in 1983 that biotechnology was targeted in the National Science and Technology Policy of Thailand's National Economic and Social Development Plan.[47] Plant biotechnology is given top

---

[47]The National Centre for Genetic Engineering and Biotechnology, a main funding agency for biotechnology research, has been supporting more than 100 projects relating to plant biotechnology during the past decade. The projects are supported under mission areas.

Plant propagation

Through the Centre's support, success has been made in plant propagation manipulating micropropagation and tissue culture techniques. It leads to the commercial production of orchids, bananas, jackfruit, oil palm, bamboo, rubber and teak trees. Progress has been made in multipurpose fast-growing trees, rattan and other fruit trees. Tissue culture technique is also used to develop disease-free seeds of potato, strawberry and sugarcane. Some of these are already at commercial production scale.

Variety improvement

With the support of the Rockefeller Foundation, a number of projects on rice are undertaken. Such projects include:

- Genetic transformation for rice ragged stunt virus resistance.
- Wide hybridisation for rice improvement.
- Identification and characterisation of genes involved in disease resistance.
- RFLP-facilitated mapping of genetic loci responsible for photoperiod sensitivity and fragrance in rice.
- QTL analysis for submergence tolerance in lowland rice.
- The improvement of an aromatic rice variety with photoperiod insensitivity.
- Screening of rice lines tolerant to drought using tissue culture technique.

In the area of plant pest resistance, success has been made in genetic transformation of papaya resistant to ring spot virus and tomato resistant to leaf-curl virus. Transgenic plants containing DNA sequence for virus coat protein showed the delay of symptom expression as

priority on the list of promoted science. The country is largely agrarian; thus, current interest in biotechnology emphasises agricultural biotechnology, including hybrid seed development and commercial plant propagation through tissue culture. The country's strategy for agricultural biotechnology has two main goals: the ability to maintain the competitive status in agricultural exports and the increased capacity of Thai farmers to apply new biotechnological tools.[48]

Since the introduction of modern biotechnology to the country, certain techniques have been mastered by a number of national research centres and

---

compared to non-transgenic plants after inoculation with the virus. The technique is quite well established and ready to extend to other crop species.

In crop improvement, stress tolerance is still a major emphasis in many crop species. Progress has been made in selection for soybean lines tolerant to saline soils using tissue culture technique. Drought tolerance maize breeding through the induction and uses of double haploids by anther culture is being undertaken.

Plant extract biotechnology

Under the ASEAN-Australia Biotechnology Project, two promising traditional herbal plants were selected to develop effective therapeutic and biologically active herbal drugs. *Diospyros mollis*, an indigenous plant, has been extensively used in Thailand for treating hookworms. The other herbal plant is *Azadirachta indica* va *siamensis*.

Apart from the ASEAN-Australia project, the Centre has been supporting projects in efforts to search for pharmaceutical compounds from plants.

Germplasm bank

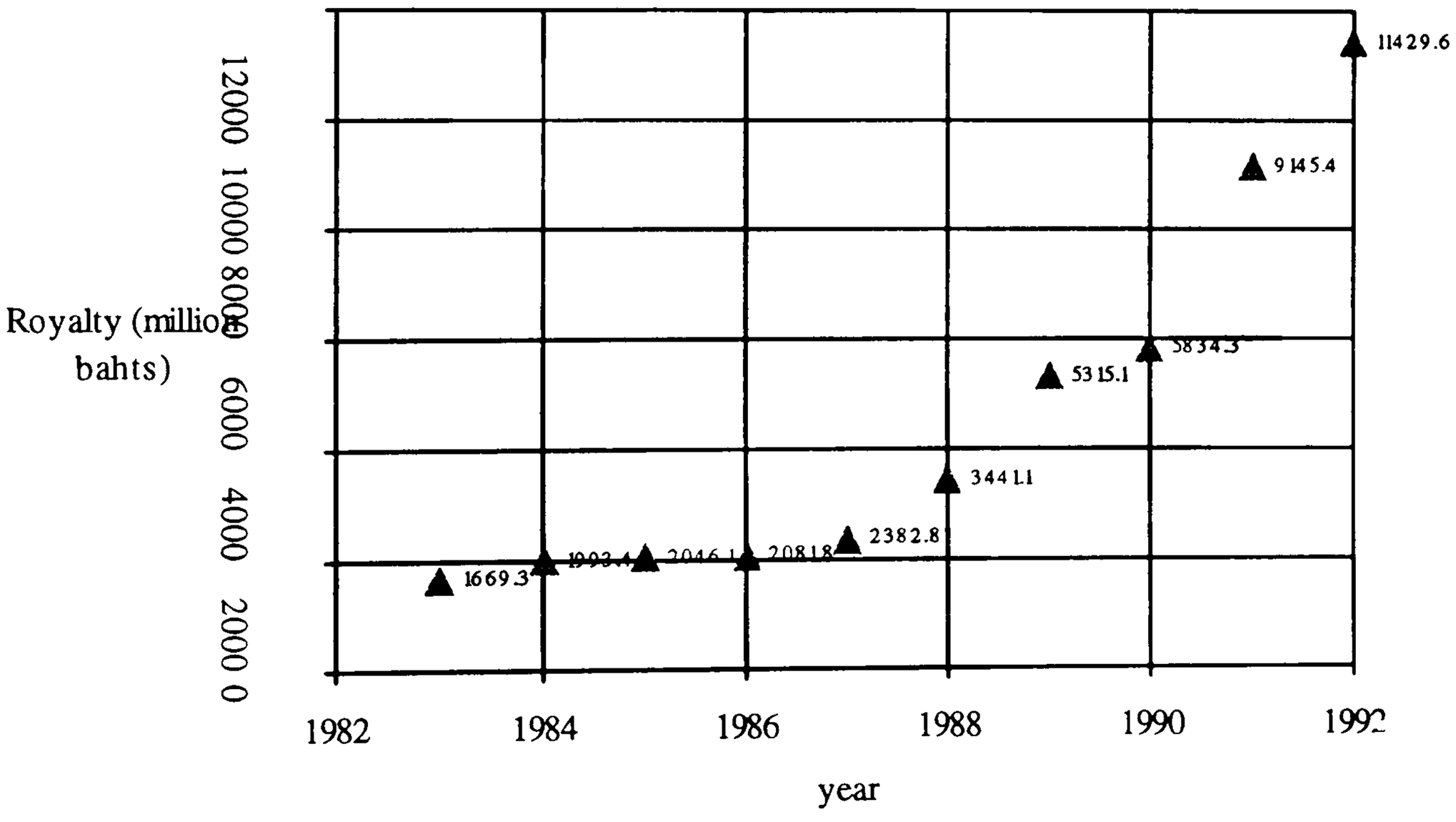
Few government agencies under the Ministry of Agriculture and Cooperatives are responsible for preserving germplasm of field crops in "Seed Gene Bank" and that of horticultural and some forest trees with recalcitrant seeds in "Field Gene Bank". The Centre has supported a research effort on *in vitro* germplasm preservation. Tissue culture and cryopreservation technology have been used to preserve germplasm of sugarcane, papaya, soybean, tomato, fruit trees and some cash crops.

(Sriwatanapongse, S. *Status of Development in Plant Biotechnology in Thailand*, Paper presented at ISAAA Biosafety Workshop in Bogor, Indonesia, 19-22 April 1993).

[48]*Future Potential of Biotechnology in Thailand*, Thailand Development Research Institute Foundation, Thailand, 1992, p. 13.

universities in Thailand. The techniques range from basic techniques, e.g. tissue culture to complicated techniques e.g. gene cloning, DNA sequencing. cell and tissue typing by using DNA and enzyme patterns, *in vitro* culture of animal and plant cells, animal and plant cell fusion, cultivar storage, monoclonal antibody production, enzyme-linked immunoassay (ELISA) kit production, embryo transfer and biopesticide production. But these techniques have not been widely used by the private sector because of the lack of trained staff and research facilities. Most private-sector investment has been made in production and quality control, not in technical research and development. Thai biotechnology firms acquire technology mostly through import.

Fig 5.2 Remittance for foreign technology licensing[49]



(40 bahts ≈ 1 pound)

---

[49]Three main imported technologies are agricultural technology, mining technology, and technology for industrial production. The majority of technologies have been imported from Japan. The figure of royalties in 1992 shows 5,653.7, 2,164.0, 607.0 million bahts were paid to Japan, the US, and Singapore respectively.

Thai plant biotechnology firms still have a relatively weak technological infrastructure although Thailand is rich in agricultural materials. However, compared to other fields of biotechnology, plant biotechnology in Thailand has developed rapidly because agriculture is the backbone of the country's economic development..

The current status of two sub-areas of biotechnology, notably tissue culture and seed technology, has been studied in Thailand.[50] Thailand's tissue culture industry comprises mainly small and medium firms which are relatively well educated and largely located in suburban areas. Tissue culture techniques have been available to the industry through diffusion from universities since the early 70's. The industry has proven successful since most staff were university researchers. Other ingredients of this success were the uncomplicated nature of the technology and the availability of skilled labour at relatively low cost.

Table 5.10 Infrastructure for seed and tissue culture technology in Thailand[51]

No of research scientists/ technologists (1988)	6,230 persons
No of plant technologists/ researchers (1988)	2,122 persons
No of tissue culture companies	15 companies
No of vegetable seed traders (1987)	42 companies
No of vegetable seed producers (1987)	14 companies

---

[50]See *The Development of Thailand's Technological Capability in Industry. Vol. 3, Capability Development for Biotechnology-Based Industry, Vol. 6, Overview and Recommendations,* Thailand Development Research Institute Foundation, Thailand, 1989 and Yuthavong, Y. et al. "Communication Strategies in Tissue Culture and Seed Research in Thailand" [1993] 28 Scientometrics 41.

[51]The information in this table is based on Yuthavong, Y. et al. *Communication Strategies in Applied and Technical Research in Thailand,* Preliminary report of research findings, National Centre for Genetic Engineering and Biotechnology, Bangkok, Thailand, 1991. This information is not recently recorded. Nevertheless, from this information, the increasing number of scientists is anticipated as a result of the government's policy.

Thai scientists are well acquainted with both knowledge and the practical skills of plant biotechnology. Many research institutes are technically capable of carrying out a DUS technical examination.[52] The Department of Agriculture in particular has a number of plant breeding stations located in many areas throughout the country and these stations possess the technical infrastructure for the examination, such as trained staff and equipment.

The application of modern techniques, such as computerised image analysis and RFLP, in PVR systems has been recommended by UPOV[53] and the UK 1988 report "The Plant Variety Testing and Seed Certification Systems in the United Kingdom".[54] These techniques have been or will be mastered by Thai scientists (particularly, in major universities with sufficient scientific infrastructure, e.g. Mahidol University, Kasetsart University and Chulalongkorn University) without undue difficulties. If a PVR system is to be introduced in Thailand and a growing test option is appropriate, should the Thai government consider the application of modern techniques in a PVR technical examination? Even though Thai scientists would apply modern techniques, these techniques seem to be inappropriate, for reasons of high cost and governmental budgetary constraint.

5.4.2. Potential application of biotechnology in plant breeding in Thailand

Thailand is at the early stage of technological development. In order to speed up this process, more funds for research and development have been injected.

---

[52]See Chapter 2 for more details about basic infrastructures needed to conduct a DUS technical examination.

[53]For example, the UPOV-Technical Guidelines for Wheat, Barley and Oats suggest protein electrophoresis should be used as part of distinctness examination.

[54]Harvey, J. et al. *The Plant Variety Testing and Seed Certification Systems in the United Kingdom*, Report to the Minister of Agriculture, Fisheries and Food, and the Secretaries of State for Northern Ireland, Scotland and Wales, February 1988.

Plant biotechnology has been developed throughout 1990s. It is predicted that by the year 2000 Thailand will enjoy the benefits of biotechnological input in certain plant species whose economic significance in terms of export value has already been demonstrated in other Asian countries, as well as in other parts of the world.[55]

Table 5.11 Future potential of plant biotechnology in Thailand

Plant/ other products	Improvement	Biotechnology input
Rice	Yield improvement from an average of 350 kg/rai to 450 kg/rai	Cell & tissue culture, gene transfer, embryo rescue, protoplast fusion, RFLP mapping and immunodiagnostic
Corn	Yield improvement from an average of 400 kg/rai to 500 kg/rai, drought tolerance	Cell & tissue culture, gene transfer, immunodiagnostic, RFLP mapping
Sugarcane	Yield improvement from an average of 8.5 ton/rai to 9.5 ton/rai, disease free planting stocks	Not reported
Multipurpose, fast growing trees	Increasing the area for reforestation to 2 million rai/year, high growth efficiency	Cell & tissue culture, protoplast fusion
Vegetables (potato, tomato, pepper)	Disease and insect resistant varieties for lower use of pesticide	Tissue culture, gene transfer, *in vitro* plantlets, electrophoresis
Cotton	Variety improvement to substitute the total import by 15%	Tissue culture, gene transfer
Soybean	High yield, variety improvement, from an average of 200 kg/rai to 300 kg/rai	Cell & tissue culture
Cassava (modified starch)	Not reported	Gene transfer, bioprocessing
Fruits and products	Preserved Thai fruits and juices	Post harvest technology, bioprocessing
Orchids and ornamental plants	Not reported	Tissue culture, gene transfer
Biofertilizer	Genetically engineered *Rhizobium* and *Mycorrhiza*	Recombinant DNA
Bioinsecticide	Genetically engineered bacteria and viruses	Recombinant DNA, bioprocessing

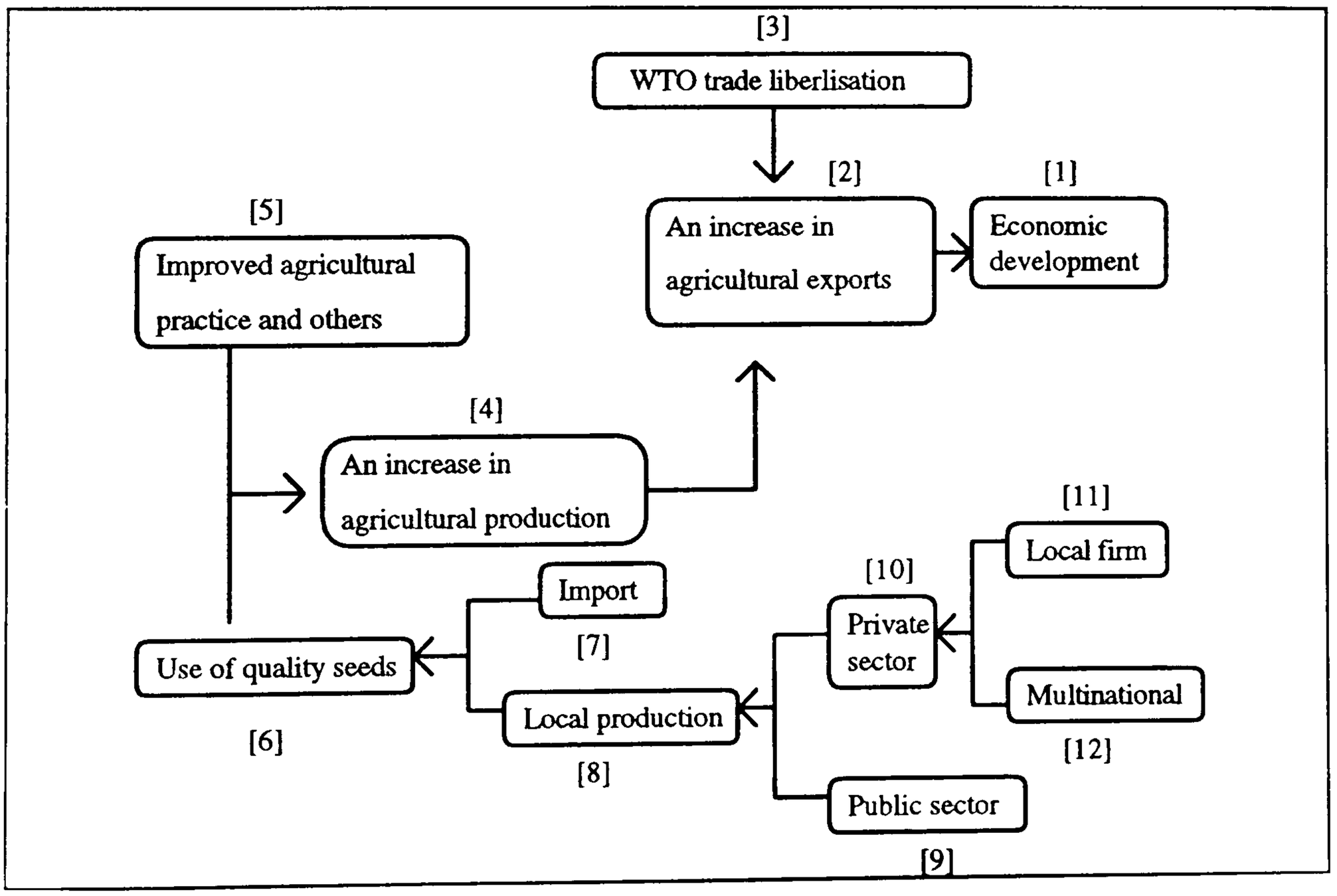
---

[55]*Future Potential of Biotechnology in Thailand*, Thailand Development Research Institute Foundation, Thailand, 1992, pp. 48-49.

Despite this optimism, firms involved in plant breeding are not expected to adopt modern biotechnological techniques in the near future (the obstacles are discussed below). However, they may benefit from the application of such techniques through cooperation with researchers in universities and public research centres.[56]

5.5. Thailand's main economic interest(s) with regard to plant breeding and seed production

The following chart and the description that relates to it summarise information from preceeding chapters and sections in way that should assist the reader to identify the main economic interests of plant breeders and seed companies in Thailand.



[56]For instance, Kasetsart University has a number of cooperative projects relating to plant development with seed companies.

[1] To promote economic development; the government has set up several national plans concerning economic and social development. The Seventh Economic and Social Development Plan identifies that key factors which have brought about development include growth of exports and investment.[57] [2] Agricultural exports have been the main contribution to the country's income. [3] Despite the 1997 economic crisis, agricultural exports themselves are anticipated to have bright prospects because of the expected benefit from trade liberalisation under the WTO agreement.[58] [4] An increase in agricultural exports is, therefore, necessary for future development. The bright future of international markets for agricultural exports requires more agricultural production. [5-6] The growth of agricultural production, in particular plant agriculture, can be boosted by various means, including the exercise of improved agricultural practice and the use of quality seed. [7-8] The Ministry of Agriculture has tried to encourage farmers to use quality seed.[59] The rising demand for such seed has proven the success of the government action.[60] At present, seed is supplied by both local production and through imports. [9-10] The quantity of seed produced locally is not enough to serve the growing demand because of the scarcity of investment; thus, seed has to be imported from various countries, such as Japan, the US and Taiwan. Currently, over 100

---

[57]This is also found in the Eighth Economic and Social development Plan (1997-2001).

[58]See Chapter 3 for more details.

[59]In Chapter 2 "Agricultural Development" of the Seventh National Economic and Social Development Plan (1992-1996), the government shall provide technical information to agricultural workers about advantages of hybrids varieties.

[60]The education process for use of quality seeds is a single step. Once farmers realise the advantages of such seeds (such as high productivity and quality) after the first use, they become repeat customers. A 1988 study assumed that a 25% replacement rate per year. (Setboonsarng. S. et al. *Seed Industry in Thailand: Structure, Conduct and Performance.* IVO Research Report No. 32, 1988.)

companies are registered as seed importers.[61] Imported seed is expensive and the use of such seed is limited to only a few farmers. The government is aware of this problem, and promote import substitution (by encouraging local production) for seed. Public sector seed production specialises in certain major crops, such as rice; private firms are active in the area of hybrids. Public sector seed production is limited because of insufficient facilities and trained staff, budgetary constraint, an ill-managed marketing system and a clear policy of avoiding competition with private firms. [12] Private seed production is dominated by multinationals because of their financial and technological strength (whilst local industries lack this basic foundation). Foreign investment has several results, including greater choices of products in the market, technology transfer and job creation. An increase in foreign investment in plant breeding and seed production is consistent therefore with the main economic interest of the country. A further question left to be tackled in Chapter 6 is whether PVR protection will boost the investment.

---

[61]Thomson, P. *Trends in Thailand's Seed Sector*, Paper presented at ASIAN SEED' 94, Chiang Mai, Thailand, 27-29 September 1994, p. 35.

Conclusion

Thailand has in recent years witnessed an economic transformation from an agricultural to an industrial base, as a consequence of the government's policy of keeping pace with world development. The record of Thailand's economic growth in the last decade is very impressive; nevertheless, the 1997 economic crisis in many respects hampers economic development.

Thailand's economic development relies heavily on exports and foreign investment. Exports, particularly agricultural commodities, are the major contribution to the country's income. Economists have projected that local and international markets for Thai agricultural products will increase due to population growth and trade liberalisation under the WTO agreement. Foreign investment has played a vital role in Thai industrial development and many important industries are dominated by multinationals because of their financial and technological strength. The Thai government has a clear policy of encouraging foreign investment because of its proven importance to economic development.

At present, plant breeding and seed production are carried out by both public and private sectors. The Department of Agriculture, universities and other research centres have engaged in plant breeding programmes, but development has been deterred by budgetary constraints and shortage of trained staff. In retrospect most of the research budget in seed industries was spent in the improvement of seed production. The industries were not interested in conducting their own plant breeding activities because they relied on imported varieties or varieties developed by public breeding stations. Recently, however, many firms, mainly multinationals, have launched plant breeding programmes. The pace of advancement in private breeding is unimpressive because of lack of

research interest. Research and development expenditure by Thai industries on plant breeding is insufficient but this is not due to the absence of intellectual property protection for plant varieties. There has never been any report concerning economic loss in the seed business due to the "misappropriation "of plant varieties.

In the past, seed production and distribution were carried out by the government, particularly for major crops. The government still assumes the task of supplying only seed which is not economically attractive to seed industries. Private seed production in Thailand is dominated by multinationals due to their financial and technological strength. At present the supply from public and private sectors cannot serve the rising demand for quality seed. A large amount of investment is needed in seed production and plant breeding. The government's budget and local financial resources are limited. Therefore, the primary economic interest of Thailand in promoting the development in plant breeding and seed production is an increase in foreign investment.

Appendix 5/1

Regulatory arrangements for plant breeding and seed production in Thailand

Country	Breeding activities	Production and distribution of seeds	Regulations on the seed industry	Plant variety protection
Thailand	Mainly by governmental organisations	Since 1977 private firms have been involved in seed production. Govermental organisations undertake seed production for species in which industries are less interested.	- Seed Act of 1975, which includes a controlled seed scheme for 25 selected plant species (prescribed germination rate and purity; random sampling from the market for the control of labelling) - Voluntary certification of seed and propagating materials (obligatory for seed produced by governmental agencies) - Publication of recommended varieties and varietal description for farmers' information	- Under the Patent law, plants and animals are excluded from patentability - Introduction of PVR legislation has been discussed.

CHAPTER 6

ECONOMIC IMPLICATIONS OF PVR PROTECTION IN THAILAND

Introduction

Interest in the economic implications of intellectual property protection is growing amongst lawyers and economists, stimulated by its increasing importance in international trade.[1] A number of empirical studies with regard to economic effects of various forms of intellectual property protection have been carried out.

The advantages arising from PVR protection must be balanced against the costs that setting up the system imposes upon society and individuals, in order to determine its net worth. To investigate whether the introduction of PVR protection will be beneficial to Thailand's economic development is the prime objective of this chapter. Chapter 5 has revealed that an increase in private investment, particularly from multinational companies, is the most important factor in the development in plant breeding and seed production. Accordingly, this chapter asked whether PVR protection will boost private investment in plant breeding in Thailand. In answering that question, the chapter discusses foreign investment in Thailand, the theoretical influence of PVR protection on investment

---

[1]Professor Cornish says: "No serious student of intellectual property law can today afford to ignore the economic arguments for and against the maintenance of these rights. Patents, copyright and trade marks each have a different form of economic impact, so a good deal must be reserved for later discussion. Underlying the whole, however, is a theoretical approach to the question of monopoly power in a market." (Cornish, W.R. *Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights*, 3rd ed., Sweet & Maxwell, London, 1996, p. 28.) The integration of the TRIPs agreement into the WTO agreement has increased the worldwide recognition of intellectual property protection.

decisions, findings from empirical studies with regard to the issue, and the speculation of such effects in Thailand.

6.1. Foreign investment in seed industry in Thailand

Foreign investment is crucial for developing countries. Thailand, in the late 1950s, began to plan its economic development through investment promotion. The Thai government sought actively to encourage all forms of investment by enacting the Industrial Promotion Act of 1954. After a number of pieces of investment promotion legislation and a variety of resulting successes for the Thai economy, the current legislative basis for domestic and foreign investment promotion in Thailand is the Investment Promotion Act of 1977 implemented by the Board of Investment (BOI).[2] The importance of intellectual property protection to foreign investment in Thailand has been recognised by the National Social and Economic Development Plan of Thailand.

Foreign investment is essential for the development of plant breeding and seed production in Thailand; it provides financial and technological resources. Multinational seed firms have used their financial and technological strengths to start new activities in Thailand which appeared too risky and costly for local entrepreneurs.[3] Investment in seed production in Thailand has increased in response to the soaring demand for quality seeds, particularly corn hybrids.[4]

---

[2]Chantikul, K. "Investment Promotion Laws" [1984] 3 Chulalongkorn Law Review 97, at 98. The Act provides certain investment incentives, including tax holidays and relief measures. Furthermore, the legislation requires no approval by any governmental entity prior to foreign investment activity. Therefore, it attracts all categories of investors interested in doing business in Thailand.

[3]Thomson, P. *Trends in Thailand's Seed Sector,* Paper presented at ASIAN SEED'94, Chiang Mai, Thailand, 27th-29th September 1994, p. 48.

[4]In 1975, Kasetsart University released the "Suwan 1" corn variety and thereafter seed firms produced and distributed Suwan 1 seeds on a large scale under BOI promotion. This move encouraged other private firms to engage in corn seed production and expand to other field crops.

During the last decade, the country has witnessed a rising investment in agriculture which includes seed production. Accumulated net flow of foreign inward-investment in Thai agriculture during 1986-1991 amounted to $108 million (compared to $20 million during 1970-85).[5] Despite this impressive upsurge in investment in seed production, Thailand's market for quality seeds is not yet saturated. As a survey in 1995 reveals,[6] the greater part of research and development budgets in the seed business in Thailand has been spent in process improvement and quality control. Nevertheless, some business executives project increased investment in plant breeding activities, stimulated by advantages of locally developed varieties.[7]

BOI investment promotion is open to all seed activities. The promotion includes duty-free import of machinery, tax exemptions and guaranteed repatriation of profits. Thailand's investment legislation has facilitated foreign investment in plant breeding and seed production. In the 1995 survey, business executives in the seed industry in Thailand recognised the influence of the BOI investment promotion schemes on their investment decisions.

(Thomson, P. *Trends in Thailand's Seed Sector,* Paper presented at ASIAN SEED'94, Chiang Mai, Thailand, 27th-29th September 1994, p. 35.)

[5]Jansen, K. *Direct Foreign Investment and Adjustment: the Case of Thailand,* Institute of Social Studies, the Hague, the Netherlands, August 1993, p. 11.

[6]A survey was conducted during 23rd January to 3rd March 1995 by the author of this thesis in cooperation with the Thai National Centre for Genetic Engineering and Biotechnology. Hereinafter referred to as the 1995 survey. See Appendix 6/1 for more details.

[7]Unlike imported varieties, such varieties likely grow in a local environment without any difficulty.

Despite Thailand's favourable regulatory arrangements with regard to investment, other factors play a vital role in investment decisions. Amongst these factors, political and economic stability are the most influential investment determinants.[8] In the past when Thailand encountered political problems, e.g. a change of government and coup d'état, the country witnessed a drastic decrease in investment because investors believed that such political problems rendered the future uncertain. The 1997 economic crisis in Thailand has brought about a considerable shake-up in the country's economic and political status which inevitably local and foreign decreases investors' confidence in all lines of business. Since the 1997 crisis, a number of foreign investors have reconsidered their investment projects in Thailand. Furthermore, the economic crises in Japan and South Korea, two important investors in Thailand, will also affect foreign investment in Thailand. These economic crises undermine the positive effect of PVR protection on investment in plant breeding and seed production (proceeding on the assumption that PVR protection encourages investment in plant breeding).[9]

6.2. Theoretical effects of PVR protection on investment decisions

PVR protection falls within the broad scope of intellectual property; therefore, it would be beneficial to look at how intellectual property protection affects investment decisions. A prime objective of any intellectual property regime is to protect the interest(s) of the owner of the property by granting him an exclusive right (or a bundle of rights) to prevent others without his authorisation from

---

[8]See the 1995 survey in Appendix 6/1.

[9]Under normal circumstances, it might be expected that introduction of PVR protection would encourage investment. Given the severity of the current economic crises, it is doubtful that PVR in itself would attract foreign investment in Thailand.

committing certain acts with regard to his protected property. Throughout its long history, there has been debate on the precise role(s) of intellectual property protection.[10] Recently intellectual property protection has taken on a new role in a world where international transaction gains increasing economic and political importance. The influence of intellectual property protection on foreign investment has been a matter of much discussion and debate.[11] One of the key arguments made by advocates of stronger global intellectual property rights is that such a system, as embodied in the TRIPs Agreement, would increase foreign direct investment (FDI) in developing countries.[12] Theoretical analysis suggests that the impact of protecting intellectual property rights is likely to be positive, although relatively unimportant in relation to other determinants of FDI.[13] The reason is that more firms would be involved in transnational transactions because of their profit-maximising decisions to exploit some combination of ownership, location or internationalisation advantages.[14]

---

[10]For instance, Canadian Working Paper on Patent Law Revision provides that a patent system can be justified as an economic instrument, i.e. by serving as an incentive for: (1) research (leading to invention); (2) disclosure (of invention); and (3) innovation (based on invention). (*Working Paper on Patent Law Revision*, prepared for the Department of Consumer and Corporate Affairs, Ottawa, Canada, June 1976, p. 29.)

[11]The importance of intellectual property to foreign investment is not a recent issue. The history of patents reveals that patents were issued in order to attract foreign inventors to establish industries in England.

[12]United Nations Conference on Trade and Development, *The TRIPS Agreement and Developing Countries*, United Nations, New York, 1996, p. 17.

[13]Dunning, J. "Toward an Eclectic Theory of International Production: Some Empirical Tests" [Spring/ Summer 1980] Journal of International Business Studies 9.

[14]United Nations Conference on Trade and Development, *Science and Technology in the New Global Environment: Implications for Developing Countries*, United Nations, Geneva, 1996.

The effect of intellectual property protection on foreign investment has been studied by a number of scholars.[15] A 1994 International Finance Corporation discussion paper has investigated the hypothesis that relatively weak intellectual property protection in a developing country may decrease the probability of multinationals investing there.[16] The study categorises industries into:

(1) Firms that rule out substantial investment in countries affording weak protection: research-intensive firms with products (or processes) that are relatively easy to imitate, e.g. pharmaceuticals, chemical firms and computer software industry.

(2) Firms that consider intellectual property protection as one of several important factors in their investment decision: some research-intensive firms (particularly outside the chemical industry), e.g. some pharmaceuticals.

(3) Firms that regard intellectual property protection as relatively unimportant in the investment decision: low-technology industries and some high-technology industries like electrical equipment.

It would appear that the "degree of ease of imitation" plays a vital role in determining the need for protection. The less easily imitated the technology employed in production, the more important the protection is. This observation is supported by the availability of counterfeit products in a market; in practice, computer software and media industries are amongst the most counterfeited

---

[15]See, for instance, Seyoum, B. "The Impact of Intellectual Property Rights on Foreign Direct Investment" [Spring 1996] Columbia Journal of World Business 51 and Sherwood, R. "Intellectual Property Systems and Investment Stimulation: The Rating of Systems in Eighteen Developing Countries" [1997] 37 IDEA 261.

[16]Mansfield, E. *Intellectual Property Protection, Foreign Direct Investment, and Technology Transfer,* International Finance Corporation, World Bank, Washington DC, 1994.

businesses. Consequently it is necessary to consider which category seed industry would fit in.

6.3. PVR protection: An investment incentive

A major argument expressed by PVR advocates is that the protection, if adequate and effective, should stimulate industries to increase investment in plant breeding activities due to foreseeable financial return (partly) secured by the protection; and, therefore, more new varieties in the market can be anticipated (and rising numbers of new varieties will be beneficial to consumers).[17]

How does PVR protection, in theory, boost investment? Early economic views of intellectual property protection developed in the context of a broad debate on the implications of monopoly.[18,19] Schumpeter was amongst the first economists who asserted that monopoly was necessary for innovation.[20] Pursuing this concept,

---

[17]Alckian suggested: "Defining the efficiency of property rights in terms of innovation has the advantage that it not only incorporates the relationship between private and social returns, but also the more general economists' view that efficient property rights are rights that produce increases in output." (Alckian, A. "Uncertainty, Evolution and Economic Theory", *Journal of Political Economy LIX;* cited in Kingston, W. *Innovation, Creativity and Law,* Kluwer Academic Publishers, Dordrecht, the Netherlands, 1990, p. 209) Obviously, more output results from effective production or an increase in input, such as raw material and investment.

[18]Siebeck, W.E. et al (eds.). *Strengthening Protection of Intellectual Property in Developing Countries: a Survey of the Literature,* World Bank, Washington DC, 1990, p. 17.

[19]Hereafter referred to as "IP monopoly", and in the context of PVR protection "PVR monopoly".

[20]The definition of "innovation" appears in a number of references. For instance, the 1976 Canadian Working Paper on Patent Law Revision suggests that "innovation" may be taken as the whole process of making an invention and carrying out subsequent steps by which it is put into commercial practice. Schumpeter has referred to innovation as an activity engendering revolutionary changes in the economic system through a process of creative destruction. (Ko, Y.

Professor Kingston further explains the relationship between property right, market power and monopoly by suggesting that monopoly arises from special form of property rights.[21]

"An Economic Analysis of Biotechnology Patent Protection" [December 1992] 102 Yale Law Journal 777) Following Schumpeter, Freeman describes innovation as the first commercial transaction involving a new product, process, system or device. (Freeman, C. *The Economics of Industrial Innovation,* Frances Printer, London, 1982) Innovation consists of three main elements: generation of an idea (which contains elements of market needs and possible technology); problem solving (which includes establishing technical goals and designing alternative solutions); and implementation (which consists of manufacturing engineering, tooling and market start-up). (Gerstenfeld, A. *Innovation: A Study of Technological Policy,* University Press of America, Washington DC, 1979, p. 3) It may be said that innovation, in its simple sense, is a process bringing an existing invention into a market or putting an existing invention to practical use. For more details about innovation, see Bradbury, J.A.A. *Product Innovation: Idea to Exploitation,* John Wiley & Sons, Chichester, 1989.

[21]Professor Kingston provides: "When Schumpeter asserted that innovation necessitated monopoly, he did so in the context of the modern corporate organisation. The corporation, however, is only one expression of a much more fundamental economic reality, which is property rights. These are rights of ownership, broadly defined as covering use and transfer of, and exclusion of other from whatever is owned. The last of these aspects of property rights is particularly interesting, because it is synonymous with market power, which, in all its manifestations, is the power to exclude, to erect barriers to entry, to escape from the constraints which the market seeks to impose by encouraging new entrants.

There is consequently a substantial area of common ground between property rights and market power, to the extent that we can perhaps say that market power is the dynamic aspect of reality whose static form is property rights. The monopoly which Schumpeter associated with innovation is a special type of market power, arising from special type of property rights,... Equally, every type of property right confers a corresponding type of market power, which, by extension of Schumpeter's principle, should be able to underwrite its own type of innovation. Property rights link the innovator's creativeness to the resources which he needs to obtain from society if he is to make that creativity productive in economic terms." (Kingston, W. *Innovation, Creativity and Law*, Kluwer Academic Publishers, Dordrecht, Netherlands, 1990, p. 79.)

Prior to making an investment companies have to consider several factors because capital is not free, and in many firms it is often scarce. Investors must be reasonably confident of profits and one important factor indicating profitability is the state of the market. The market must be profitable as well as secured; no sensible investors want to enter a profitable market which is uncertain since it may take a certain period for them to recoup investment and gain benefit.

Profitability of the market is mainly indicated by the level of demand. It is obvious that investors are attracted by a market where demand outstrips supply in the long term. Security of the market, in a general sense, depends on the degree of competition in the market. A competitive market seems to be uncertain for investors since their products may be replaced by competitors' products. Exclusive rights conferred by PVR protection provide the rights-owner with certain forms of control over the relevant market.[22]

However, an "intellectual property protection equals monopoly" concept has proven untrue under certain circumstances. Professor Cornish asserts that all intellectual property consists in the exclusive right to perform some defined activity, in the main productive or commercial; nonetheless, this is not at all the same thing as the ability to exert monopoly within a market.[23] For example, if a

---

[22]Sherwood provides that intellectual property protection is designed to reduce investor's risks. This is accompanied by offering exclusive rights, not to a market itself, but to the means to compete in market activity. (Sherwood, R. "Intellectual Property Systems and Investment Stimulation: The Rating of Systems in Eighteen Developing Countries" [1997] 37 IDEA 261.)

[23]Cornish, W.R. *Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights*, Sweet & Maxwell, London, 1996, p. 30.

Duvick states: "The term, monopoly, commonly is used in more than one senses. Definitions of monopoly can range from exclusive control of an irreplaceable commodity or service in a

protected product can be substituted by other products, the owner of such a product cannot enjoy monopoly.

In recent years, the possible influence of PVR protection on investment decisions has been discussed in both academic and business circles.[24] In 1979 Mooney cast doubt on the positive aspects of PVR protection[25] by suggesting that in creating

---

particular market, down to simple exclusive possession or control of a unique but not irreplaceable piece of property. With the first kind of monopoly, sometimes called "a true monopoly", there is the opportunity to set prices, regardless of the usual supply and demand forces. With the second type, at the other end of the scale, market forces are the predominant lever for setting prices and determining profitability" (Duvick, D.N. "Goals and Expectations of Industry for Intellectual Property Rights for Plant Materials"; in Baenziger, P.S. et al. (eds.). *Intellectual Property Rights: Protection of Plant Materials,* CSSA Special Publication No. 21, Crop Science Society of America, American Society of Agronomy and Soil Science Society of America, Madison, USA, 1993, p. 22)

[24]Wijk submits that although empirical countries still lacking, there is a growing consensus that adequate protection of intellectual property rights is necessary for stimulating investment in biotechnology. (Wijk, J.V. et al. *Intellectual Property Rights for Agricultural Biotechnology: Options and Implications for Developing Countries,* Intermediary Biotechnology Service, Netherlands, 1993)

On the contrary, Duvick provides that from his extensive experience with plant variety protection, the protection alone cannot guarantee needed controls over proprietary products of research, nor can it guarantee a profitable business. (Duvick, D.N. "Goals and Expectations of Industry for Intellectual Property Rights for Plant Materials"; in Baenziger, P.S. et al (eds.). *Intellectual Property Rights Protection of Plant Materials,* CSSA Special Publication Number 21, Crop Science Society of America, American Society of Agronomy and Soil Science Society of America, Madison, 1993, p. 26.)

[25]Professor Dworkin submits: "The plant breeders' rights system, in particular, has become embroiled in international controversy on social, political and economic grounds. The catalyst for the present controversies has been a book by Mooney, P.R. *Seeds of the Earth - A Private or Public Resource?,* published in 1979 by the International Coalition for Development Action. This group has spearheaded a worldwide campaign against the world concept of plant breeders' rights with considerable impact: it has reinforced the hostility of some Third World developing

restrictive legislation on plant varieties, governments should not naively assume they are leading the way to new and innovative forms of plant breeding or an increase in the over-all number of plant breeders.[26] Thereafter economic effects of PVR protection, particularly on investment decision, have been assessed in both developed and developing countries.[27] The scepticism about the possibility of PVR protection encouraging investment in plant breeding has grown because of the lack of concrete evidence supporting the possibility. Despite the growing scepticism, it would be unwise to presume that Thailand would expect a similar outcome due to differences in many respects between Thailand and the other countries. The following section will investigate the possibility of PVR's role as an investment encouragement under Thai circumstances.

6.4. Potential effects of PVR protection on investment in plant breeding and seed production in Thailand

The discussion in Chapter 5 suggests that an increase in private investment in plant breeding and seed production would be beneficial to Thailand's economic development. It may be seen that investment in plant breeding and that in seed production are two separate types of investment: research investment (spent in inventive activities of developing new varieties) and manufacturing investment

---

countries towards such monopoly rights and it has made it more difficult for those countries which are thinking of introducing plant variety legislation to do so, since the organised campaign in opposition can be very effective in sowing seeds of doubt in the minds of the uncommitted."
(Dworkin, G. [1983] 10 European Intellectual Property Review 270, at 270)

[26]Mooney, P.R. *Seeds of the Earth: A Private or Public Resource?*, Canadian Council for International Co-operation, Ottawa, Canada, 1979, p. 87.

[27]See Appendix 6/2 for the summary of empirical studies on economic implications of PVR protection.

(seed production). Nevertheless, it is preferable to deal with them together because more commercial plant breeding activities in Thailand have recently been carried out by seed industries. Exceptionally, some public institutes, under certain forms of contractual arrangement, develop new varieties for private companies. New plant varieties are one of the raw materials in seed production. Accordingly, from a commercial viewpoint, plant breeding should be seen as part of seed production.

Whether or not PVR protection would enhance investment in plant breeding and seed production in Thailand requires consideration of the following:[28]

[1] Impracticality of counterfeiting in plant breeding and seed production:

The economic importance of intellectual property protection varies amongst industries.[29] One much studied aspect of the economic implications of intellectual

---

[28]In investigating the effect effects of intellectual property protection, the 1976 Canadian Working Paper on Patent Revision proposes an interesting way of examining the effect of the protection on investment decisions by asking the following question: "Do intellectual property rights (or rights to obtain the rights) induce investors to proceed into areas that they would not have otherwise entered?" or "But for the grant of the rights, would industry have performed in any different manner?" A reward offered as an investment incentive is a useless and wasteful gesture if it is granted for conduct that would have taken place in any event. However, this investigative approach is appropriate for only an investigation carried out after the introduction of legislation.

[29]Even in the same area of intellectual property protection, its economic importance varies from industries to industries due to the natures of industries.

For the economic importance of trade marks, see, for example, Maniatis, S.M. "Competition and the Economics of Trade Marks"; in Sterling, A. (ed.) *Perspectives on Intellectual Property: Vol.2 Intellectual Property and Market Freedom,* Sweet & Maxwell, London, 1997, pp. 65-130.

For the economic importance of copyright, see, for instance, Phillips, J. *Economic Importance of Copyright*, Common Law Institute of Intellectual Property, London, 1985.

For the economic importance of patents, see, for example, Firestone, O.J. *Economic Implications of Patents,* University of Ottawa Press, Canada, 1971 and Silberston, A. *The Economic*

property protection is the influence on investment decisions, particularly in developing countries allegedly without adequate protection. As previously mentioned, the relationship between intellectual property rights and foreign investment is not the same for all industrial sectors; research-intensive firms dealing with products or processes that are relatively easy to imitate, assert that they will not make substantial investment or transfer advanced technology to countries with weak intellectual property protection.[30] "Easy to imitate" is a key element to determine the need for protection. "Easy" in this context should be used in not only technological but also practical senses. As discussed in Chapter 1, most seed production (except the production of F1 hybrids) employs non-complicated technology but involves many steps which require extensive labour, machinery and other infrastructure. This requires considerable investment. Most commercial seeds are produced by farmers under certain forms of contractual arrangements, e.g. an agreed price per kilogram and no seed retained by farmers for other purposes. Despite the possibility that farmers may retain a certain quantity of seeds without the knowledge of contracted seed firms, this is unlikely to result in any significant

---

Importance of Patents, Common Law Institute of Intellectual Property, London, 1987 and Scherer, F.M. *Industrial Market Structure and Economic Performance,* 2nd ed., Rand McNally, Chicago, 1980, p. 446.)

The economic importance of PVR protection can be seen only in seed industry since plant varieties are mainly used in this line of business.

[30]Also see Mansfield, E. *Intellectual Property Protection, International Finance Corporation,* Discussion Paper 19, World Bank, Washington DC, 1994.

The Taylor's study concludes: "The impact on rate and direction of inventive and innovative activity undertaken by industry is extremely small on the whole in all areas examined except the 'secondary' (non-basic) chemical industries. There, pharmaceuticals stand out as an industry and innovation is heavily dependent on patent protection." (Taylor, C.T. et al. *The Economic Impact of the Patent System: A Study of the British Experience,* Cambridge University Press, Cambridge, 1973.

commercialisation of retained seeds.[31] Furthermore, as mentioned in Chapter 5, the commercialisation of controlled seeds in Thailand is subject to the 1975 Seed Act which imposes minimum standards for commercial seeds, including purity and germination rate.[32] In order to achieve the standards, seeds must be produced with great care. Manufacturers of controlled seeds must register their business with the Department of Agriculture. These conditions for seed production would deter small investors from engaging this business.

[2] Lack of market:

The importance of intellectual property protection may be indicated by the number of dispute cases or misappropriations of property. So far, the numbers of reported cases of misappropriation of plant varieties are relatively small (even in countries where PVR protection has been long established), compared to those in other fields of intellectual property protection.[33] One possible reason for the scarcity of dispute cases is that misappropriation of plant varieties is not commercially practical or important (even if practicable). Growth in the business of counterfeiting depends mainly on the profitability of the market. Adam Smith's classic economic theory on the relationship between demand and supply suggests that the market or demand would indicate the need for supply. The market

---

[31]The main reason is the lack of marketing skill and strength of Thai farmers.

[32]Controlled seeds are seeds of plant species which are officially notified by the Ministry of Agriculture. Up to present 25 species (rice, 7 field crop species and 17 vegetable species) have been notified. The list of notified species covers most commercially important plant species in the Thai market.

[33]Despite the lack of statistical data concerning PVR infringement cases, the scarcity of PVR cases in law reports or journals may imply the rarity of misappropriation. For instance, Since 1993, a British law report has published only one case, namely *Germinal Holdings Ltd* v. *H.R. Fell & Sons Ltd* [1993] Fleet Street Report 434.

depends on many factors, including consumers' behaviour and their financial status. Most counterfeiting businesses are concentrated in developing countries where purchasing power is low and intellectual property protection is not available (or the enforcement is ineffective). Customers with adequate capital usually prefer to purchase authentic products, especially in the case of goods where quality guarantee and after sale service are significant in consumer choice.

If the market is profitable, counterfeiters may be prepared to risk prosecution, in the knowledge that punishment, if it occurs at all, may be minimal and fines derisory. An explanation of why there is little or no misappropriation of plant varieties may be that counterfeiting seed is not a profitable business. The seed market is different from other markets in the sense that seed users, i.e. farmers, do not normally buy seed in ordinary shops; they buy it from recommended suppliers or tried sources. Brands and brand advertising have a strong influence on farmers' decision to purchase seeds. The most common media for seed advertising in Thailand is a radio station broadcasting farmers' favourite programmes, such as country music and radio soap. Some business executives in seed industries in Thailand submit that advertising is one of the most important marketing strategies and a large slice of their firms' budgets are allocated to this activity. Extension service of the Ministry of Agriculture is also influential. The Ministry has local staff working closely with farmers throughout the country. The Department of Agricultural Extension normally send out information about new varieties (particularly recommended varieties) to these staff.[34] The future of farmers relies

---

[34]According to personal experience of one year employment (in 1988) in the Department of Agricultural Extension, it may be observed that Thai farmers tend to follow the advice from these local staff. As a consequence, the popularity of new varieties depends on the promotional actions

on the quality of seeds; therefore, they tend not to take a risk. In Thailand, the government tries to guard against farmers purchasing low quality seeds by distributing seed via established organisations under the government's control.[35]

These channels for seed distribution do not facilitate a market in counterfeit seeds; and the application of technical skill and investment in seed production is another reason for the absence of the misappropriation of plant varieties in Thailand.

[3] Low priority in investment decisions

A number of studies show the low ranked priority of PVR protection in investment decisions. Jaffe's study revealed that business executives in Argentina's seed companies saw no connection between investment decision and the presence of the protection. Wierema's study stated that the low priority of PVR protection in investment determinants was confirmed in a study amongst 28 seed companies in Europe, Japan and the US.[36]

What do business executives in seed firms in Thailand think about PVR protection? The history of the seed business in Thailand does not hinge on the importance of (need for) PVR protection or any equivalent form of protection. Since the advent of plant breeding activities in Thailand, plant varieties have not

---

of the extension service. The widespread use of corn hybrid is a fine example of the success of such service.

[35]For example, the Thai Seed Act of 1975 provides that the commercialisation of controlled seeds (aggregate, sell, import, export and bring in transit) is permissible only in the case of obtaining a licence from a seed inspector.

[36]Wierema, H. *Seed Industry Development in Developing Countries: A Survey amongst Private Seed Companies in the North*, Research Report No. 35, Development Research Institute, University of Tilburg, Netherlands, 1989.

been subject to legal protection under Civil and Commercial Code, Criminal Code, and an intellectual property regime;[37] nonetheless, seed industries have made investments in seed production and increasingly in plant breeding programmes. clearly confident of recouping their investment. Some business executives have revealed that the investment, in particular in seed production, has increased constantly as a result of a rising demand for quality seeds. Firms have performed well without the protection[38] and according to empirical studies, there is no concrete evidence that the introduction of protection would enhance (or even harm) the performance.

It has been argued that Thai industries are favourably disposed to the introduction of PVR protection. But are these views reliable? The need for protection can to a certain extent be gauged by the attitude of particular interest groups. In many countries, public hearings are organised to collect views from various groups; the views may provide governments with information which may be used to construct beneficial laws. Nevertheless, these attitudes should be analysed with great care since some may express their views without sufficient knowledge of the subject(s) concerned; and some may express views that would be beneficial to them without considering the public interest. Such views should be weighted accordingly and a balance struck between the interest of these groups and public interest. The first task in assessing such attitudes is to identify interest groups. In the field of PVR protection, interest groups may be divided into creators and users of plant varieties. Creators include seed companies, public research institutes and

---

[37]See Chapter 4 for more details.

[38]See the 1995 survey in Appendix 6/1 for more details. According to business executives in seed industries in Thailand, the industries have never been suffered from economic loss from the misappropriation of plant varieties.

individuals, whereas users are mainly seed firms and farmers. Therefore, views from these groups will be examined.

The Thai Department of Intellectual Property held a number of seminars, inviting certain groups to express their views towards the introduction of a PVR regime. The participants were representatives from industries and public research institutes. End users of plant varieties, i.e. farmers, did not participate because of lack of interest mainly resulting from insufficient education. Two main opposing views were put forward; most multinational companies welcomed the protection, whereas some academic representatives feared that the protection would have certain negative consequences.[39] Industry representatives explained that PVR protection would encourage them to engage in plant breeding activities. The academic representatives took a negative view of the introduction claiming that the consequence would be that farmers would pay a higher price for seeds of protected varieties. Such arguments for/against PVR protection are not convincing because they were based on information obtained solely from popular newspaper and articles rather than thorough research studies.

This is supported by the 1995 survey.[40] Most who participated in the survey revealed their ignorance of PVR protection; nevertheless, they expressed views favourable to protection, claiming that they would be likely to seek the rights for their plant varieties. When the participants were questioned about problems they encountered in the absence of PVR protection, none could identify any. Participants were also asked about the current problems concerning plant breeding activities; the most common problems stated were shortage of well-trained staff,

---

[39]This point will be discussed in Chapter 7.

[40]See Appendix 6/1.

facilities and budget and the lack of interest in research and development. Obviously, these problems are not associated with the absence of PVR protection. Furthermore, when participants favourable to PVR protection were asked why they did not take any action in order to demand that the government introduced the protection, they could not give a cogent or sensible answer, often pleading ignorance of its existence in other countries.

Even though the company representatives who were interviewed saw a need for PVR protection, they could not substantiate the need. Despite the absence of protection, firms are expected to invest in plant breeding programmes in fields where the market is expected to be lucrative. The 1995 survey did not show that intellectual property protection was on the list of main investment determinants for plant breeding and seed production. Some of those interviewed claimed that the current level of investment has given maximum profit per production unit. Hence, the statement that the plant breeders and seed companies need PVR protection seems at least to be contentious.

The investigation in previous paragraphs focused on the micro-economic aspect of PVR protection. Recently, intellectual property protection has taken on new significance in economic and political terms, as a frequent topic in discussion on international trade. The degree of importance may be seen by the US government's action (as a consequence of pressure from American companies) against perceived inadequate protection in other countries. US businesses claimed that they suffered considerable economic loss resulting from the absence or ineffective enforcement of intellectual property protection for their products in certain countries and they pressed the US government to take action, by imposing trade sanctions against those countries. Economic pressure caused Thailand to introduce new copyright

legislation and revise its patent protection.[41] Interestingly, no issue of PVR or any equivalent protection was put forward in any negotiation between Thailand and the US or other intellectual property exporting countries (the US is one of the main seed exporters to Thailand[42]). This suggests that it has little or no importance to foreign investors in Thailand and that the absence there of PVR protection does not affect their economic interests.

One may question why the issue of legal protection of plant varieties was addressed in the WTO negotiation.[43] Do developed countries really need PVR in developing countries where they have invested in seed industries and to whom they export varietal material? It has never been reported that developed countries have suffered serious economic loss through the lack of PVR in developing countries, particularly Thailand. Presumably, it is rather the case that developed countries have taken the opportunity of powerful trade talks to include all aspects of intellectual property protection because they may be useful in the future when a problem occurs.[44]

---

[41]See Chapter 4 for more details.

[42]See Chapter 5 for more details.

[43]Katzenberger has explained the reasons for the inclusion of intellectual property protection in the TRIPs agreement as part of the WTO agreement: the increasing economic significance and hence the need for protection of the property protected by these rights, the deficits in traditional international protection of these rights and the questionable nature of unilateral and bilateral. (Beier, F-K, et al. (eds.) *From GATT to TRIPs - The Agreement on Trade-Related Aspects of Intellectual Property Rights,* Max Planck Institute for Foreign and International Patent, Copyright and Competition Law, Munich, 1996, p. 7.)

[44]An observation in Chapter 3 is that US industries have not suffered economic losses from piracy in all areas of intellectual property; nonetheless, the US has exaggerated the situation and presented it in trade fora to persuade developing countries to improve all forms of intellectual property protection.

All considered, therefore, the forthcoming introduction if PVR legislation will not serve as an incentive for investment by foreign companies.

The WTO trade negotiation seems to be an appropriate forum for developed countries, like the US, to exercise their economic strength (in other areas, such as agricultural products) in order to press developing countries to improve their intellectual property regimes. The main reason is that most intellectual property products themselves do not provide developed countries (the main creators) with bargaining power. Developing countries are the important importers of such products; therefore, the loss of sale in these countries means the economic loss for industries in developed countries. Copying these products is not difficult, for instance, a computer software can be copied by a normal computer within less than an hour; therefore, refusal to import such products will not prevent them from being marketed in developing countries.

Conclusion

The current status of plant breeding and seed production in Thailand indicates that rising investment in both activities would be beneficial to the country's economic development. Foreign investment (by multinational seed firms which dominate Thailand's seed production and commercialisation) is the most important developmental need for plant breeding and seed production in Thailand. The Thai government has always had a policy favourable for foreign investment. Many measures have been introduced to encourage such investment. The importance of such investment has led to an investigation whether the imminent introduction of PVR protection in Thailand will boost investment in plant breeding and seed production.

In recent years, various economic implications of PVR, particularly its effect on investment decisions, have been assessed by experts in developed and developing countries. There is a dearth of empirical evidence confirming that PVR protection is influential on investment decision(s). Even though the historical development of plant breeding in some countries shows an impressive increase in plant breeding activities after the passage of PVR legislation, it has not been confirmed that such an increase was directly associated with, let alone caused by, the protection. Some commentators have even suggested that the increase in plant breeding resulted from other factors, including growing demand and technological development.

Having analysed relevant information from the history and current status of plant breeding and seed production in Thailand, it is suggested that PVR protection will have little or no effect on investment in commercial plant breeding and seed production. Counterfeiting in plant breeding and seed production is impractical due

to the nature of both activities. Lack of market for counterfeiting plant varieties and seeds, which results from the consumers' behaviour and the channels of seed distribution in Thailand, undermines the need for legal protection for plant varieties. Furthermore, the historical development of plant breeding and seed production in Thailand does not reflect any real need for protection. Business executives in Thai seed industries have never regarded existing intellectual property protection as one of their influential investment determinants.

Appendix 6/1

The 1995 survey

The survey was conducted by the author of this thesis and the National Centre for Genetic Engineering and Biotechnology, Thailand during 23rd January to 3rd March 1995. The survey was done by sending out a questionnaire and interviewing certain relevant people, notably R&D managers. The questionnaire contained certain questions:

(1) names of an interviewee and a company/ institute;

(2) main activities of a company/ institute;

(3) main products;

(4) research budget in plant breeding;

(5) research policy;

(6) current problems with regard to plant breeding activities;

(7) attitude toward PVR protection

(7.1) an understanding of the protection

(7.2) the need for the protection/ reasons

(8) important determinants of investment in plant breeding and seed production

Result of the survey:

1. Twelve firms and seven government research institutes were selected on the basis of their activities in plant breeding programmes. The selected industries are: (1) Agro-town Co. Ltd (2) Bangkok Seed Industry Co. Ltd (3) C.P. Agro Industry Co. Ltd (4) Chia Tai Co. Ltd (5) East-West Seed Co. Ltd (6) Pacific Seeds (Thailand) Ltd (7) T.C.C. (Agriculture) Co. Ltd (8) Uniseed Co. Ltd (9) Cargill Co. Ltd (10) Monsanto (11) Ciba Geigy and (12) Pioneer. These industries are

main seed industries in Thailand. The selected public institutes are (1) Kasetsart University (2) Chulalongkorn University (3) Mahidol University (4) Chiang Mai University (5) Prince of Songkla University (6) Department of Agriculture (7) Thailand Institute of Scientific and Technological Research.

2. Most interviewees were reluctant to reveal their research budget and sources of plant varieties which were used to produce seeds. Some revealed that they had cooperative projects with university researchers; but the details of the projects remain confidential. Most research budget has been spent in process improvement and quality control of seed production.

3. Research policy in the private sector was determined by the market whereas public research policy had to respond to the National Development Plan which focused on public interest.

4. Most interviewees in seed companies (91.7%) were favourable to the protection. Their reasons were that legal protection under current jurisdiction was inadequate and that PVR protection would provide security to their investment in plant breeding programmes. Moreover, they believed that the protection would increase the inward flow of new varieties from abroad. Therefore, they would file a PVR application for their varieties; however, they would not release their varieties to their competitors.

Most technical research in seed companies involved the improvement of production and techniques employed were simple. Even though they were aware of the development of modern techniques in the country, such as genetic engineering and protoplast fusion, they recognised it would take sometime to bring

these techniques into practical use. Their plant breeding programmes did not involve any form of cosmetic breeding.

Most interviewees in public research institutes (85.7%) were not favourable to the protection since they thought that the protection would make it more difficult to get access to protected plant varieties.

5. The understanding of PVR protection was poor amongst interviewees. Nevertheless, it is not surprising since the subject itself was quite complicated, particularly to persons without legal knowledge.

6. Important investment determinants include:

- Market;
- Political and economic stability, e.g. inflation and interest rate;
- Financial situation of the firms;
- Others, e.g. BOI privileges and government policy.

Appendix 6/2

Summary of empirical studies on economic implications of PVR protection

The UK experience

It was reported in 1960 that plant breeding in the United Kingdom was carried out mainly by State-supported breeding stations.[45] Private investment in plant breeding was very low; seedsmen gave most attention to the business of maintaining varieties true to type by selection. The State was responsible for the breeding of some major agricultural and horticultural varieties, for example, potatoes, fruits, grasses, clovers and cereal. The breeding of vegetables was divided equally between the public and private sectors. Private breeders were predominant in the breeding of field crops, flowers, shrubs and decorative varieties.

Commercial breeding was declining before the introduction of the 1964 Plant Varieties and Seeds Act and since the passage of the law, it was reported that (from 1967 to 1983) the UK benefited from improved varieties; wheat yields increased by 105%, barley by 59% and oats by 49%.[46] Harvey's study concludes that the introduction of the legislation provided a greater incentive to plant breeders for the continuing investment necessary to produce new varieties. The British Association of Plant Breeders has listed some successes of the 1964 Act:

(1) The number of plant breeding organisations has significantly increased.

---

[45]*Plant Breeders' Rights: Report of the Committee on Transactions in Seeds,* Cmnd. 1092, HMSO, London, 1960.

[46]Harvey, J. et al. *The Plant Variety Testing and Seed Certification Systems in the United Kingdom,* Report of the Ministry of Agriculture, Fisheries and Food, and the Secretaries of State for Northern Ireland, Scotland and Wales, February 1988.

(2) Both public and private sector breeders are producing an increasing flow of new varieties and the UK is more than holding its own against international competition.

(3) Farmers have a wider range of varieties to choose from. They are thus able to select those varieties most suitable for their area and cropping plan.

(4) Plant breeding has increased farm productivity dramatically.

(5) Farmers recognise the benefits of new varieties; they understand the need for, and the relative insignificance of, royalty payments.

(6) The national economy has benefited; for example, through increased productivity at no extra cost to the farming community; self-sufficiency in cereals; and agricultural export earnings.

(7) By stimulating plant breeding, the 1964 Act has brought wider genetic variation to British crops. For example, through providing variety protection, the 1964 Act encouraged foreign breeders to test their varieties for suitability in UK conditions.

(8) Breeders have increased disease resistance, and in wheat alone this has saved farmers £170 million over 10 years.[47]

Did such successes really result from the advent of PVR protection? It may be observed that:

(1) Coincidentally, the successes were assessed during the period of the Green Revolution (between the mid-sixties and mid-seventies) when scientists throughout the world developed new plant varieties and improved agricultural practice. Millions of additional acres were cultivated, and newer machines, more fertilisers,

---

[47]British Association of Plant Breeders Document, 2nd March 1983; cited in Dworkin, G. "The Plant Varieties Act 1983" [1983] 10 European Intellectual Property Review 270.

better irrigation, and crop rotation were introduced to farming across the world.[48] From 1950 to 1984, food production rose faster than ever before in human history: world grain harvests rose 2.6 times in those years, which was more than the increase in global population.[49] Production of root crops, meat, milk, fish, fruits, and vegetables also expanded, in response to worldwide demand for food caused by population growth and enhanced living standards. Accordingly, it is unclear whether the successes were a consequence of technological development of the Revolution.

(2) Did such successes result from an increase in private investment (as a consequence of the introduction of PVR protection)? The status of the country's economy and plant breeding activities during the period suggests not. The performance of the country's economy in the 1970s was poor; investment rate was very low.[50]

---

[48]The CIMMYT staff would readily admit that much of the increased yield surrounding the revolution is due to the heavy application of fertilisers and herbicides. (Peters, C. "The Browning of the Green Revolution" *Country Guide,* p. 18; cited in Mooney, P.R. *Seeds of the Earth: A Private or Public Resource?*, Canadian Council for International Co-operation, Ottawa, Canada, 1979, p. 41)

[49]Kennedy, P. *Preparing for the Twenty-First Century,* Harper Collins Publishers, London, 1993, p. 66.

[50]During this period, there was a drastic change in policy direction arising from the different political outlooks of the Conservative and Labour parties which had a considerable effect on the country's economy; two periods of two main political parties - the Heath government of 1970-4 and the Wilson-Callaghan administration of 1974-9. The lack of continuity since 1964 between one government and another in various aspects of economic policy has already prompted one economist to refer to the period as 'the Jekyll and Hyde years'. (Maunder, P. (ed.) *The British Economy in the 1970s,* Heinemann Educational Books, London, 1980, p. 2.

The White Paper entitled An Approach to Industrial Strategy concluded the status of economy in this period:

Did the improvement in yield result from the technological development in plant breeding (the Green Revolution) rather than an increase in investment (as a consequence of the passage of the 1964 Act)? Since this question remains unanswered, it is doubtful that a correlation exists between the theoretical economic role of PVR and its actual effects.

The US experience

The passage of the 1970 US Plant Variety Protection Act was a result of a long standing attempt by American breeders to protect sexually-reproduced plant varieties. Since the enactment, some effects of the legislation have been assessed by a number of experts.[51]

"Investment: A low rate of investment; inefficient use of capital, which has resulted in a relatively poor return on new investment; poor choice of investment.

Government: Sharp and frequent changes of economic regulators to meet the conflicting needs of economic and social priorities, which make it difficult for companies to plan ahead; pre-emption of resources by the public sector and by personal consumption to the detriment of industry's investment and export performance; and Government intervention in the pricing, investment and employment policies of the nationalised industries.

Finance: A decline in the rate of industrial profitability: imperfections in the capital market mainly at the medium - and longer-term ends; a capital market which does not give priority to the needs of industry."

(*White Paper on an Approach to Industrial Strategy,* Cmnd. 6315, HMSO, London, 1975. p. 5)

[51]See, for example:

Claffey, B. "Patenting Life Forms: Issue Surrounding the Plant Variety Protection Act" [December 1981] 13 Southern Journal of Agricultural Economics 29;

Barton, J.H. "The International Breeder's Right System and Crop Plant Improvement" [June 1982] 216 Science 1071;

Ruttan, V. "Changing Role of Public and Private Sectors in Agricultural Research" [April 1982] 216 Science 23;

In the US, the purchase of seed by farmers from the seed industry accounted for some $3.9 billion in 1980, equal to approximately 6 per cent of the value of crops sold. Almost all corn and sorghum seeds were hybrids produced by private seed firms whereas public research institutes work on some of the more basic research problems in the breeding of these crops and the fruits of their efforts generally became public property.[52] In contrast, some varieties, such as soybeans, wheat and other cereals have been developed by public institutes. The seeds of these varieties have been distributed to farmers through the certified seed system implemented by the government.

Did the protection stimulate private investment in plant breeding? The statistics presented to Congress in 1980 showed that the breeding of new varieties of wheat, soybeans, and cotton increased three to six times[53] and private investment in plant research increased two to three times in the decade after the enactment of the 1970 Plant Variety Protection Act.[54] However, Kloppenburg observed that this trend of

---

Perrin, R.K. et al. *Some Effects of the U.S. Plant Variety Protection Act of 1970,* Economics Research Report No. 46, Department of Economics and Business, North Carolina State University, North Carolina, August 1983; and

Lesser, W. H. et al. *An Economic Analysis of the Plant Variety Protection Act,* American Seed Trade Association, Washington, D.C., 1983.

[52]Perrin, R.K. et al. *Some Effects of the U.S. Plant Variety Protection Act of 1970,* Economics Research Report No. 46, Department of Economics and Business, North Carolina State University, North Carolina, August 1983.

[53]It may be seen that the breeding of these varieties is mainly carried out by public institutes. An increase in new varieties may result from technological development or an increase in government budget which might have nothing to do with the passing of the 1970 Act.

[54]House Rep. No. 96-1115, 20th June 1980 to accompany House Res. 999 (Plant Variety Protection Act-Certification), pp. 13-14; cited in Barton, J.H. "The International Breeder's Rights System and Crop Plant Improvement" [1982] 216 Science 1072.

expansion could be traced back to 1960 and, therefore, suggested that the expansion resulted from continuous growth of research investment prior to the enactment of the legislation.[55] He concluded that the commodities boom in the 1970s as a result of an increase in plantation of soya bean and wheat might stimulate the investment. A study by Perrin in 1983 showed research expenditures per sale of some varieties decreased after 1970.[56] It is interesting to note that the Perrin study and the statistics presented to Congress showed conflicting data.

According to Ruttan, experience with the 1970 Act resulted in a number of changes in perception regarding the effect of variety protection. Most participants in the amendment debate concluded that the Act has encouraged an expansion of plant breeding efforts in the private sector. Fears that the Act would lead to excessive litigation have not been realised. Much of the opposition to variety protection by public breeders has disappeared. (Ruttan, V.W. "Changing Role of Public and Private Sectors in Agricultural Research" [1982] 216 Science 25.)

According to Butler of the Department of Agricultural Economics, University of Wisconsin-Madison, the protection did not pose any significant advantage or disadvantage to plant breeding programmes.

"... the alleged benefits from PVR - namely stimulation of plant breeding research - have been realised only in soybeans and to a lesser extent wheat. There is no evidence that PVPA (the Plant Variety Protection Act) has triggered large investments in plant breeding R&D nor of large improvements in either techniques or in plant quality... it is only fair to point out that feared costs of PVPA - increases in prices, market concentration and advertising and decreases in information exchange and public plant breeding - have been modest or negligible." (Letter dated 13th October 1983, p. 1; cited in Senate Standing Committee on National Resources, The Parliament of the Commonwealth of Australia, *Plant Variety Rights,* Australian Government Publishing Service, Canberra, Australia, 1984, p. 7)

[55]Kloppenburg, J.R. (Jr.), *First the Seed: The Political Economy of Plant Biotechnology 1492-2000,* Cambridge University Press, Cambridge, 1988, p. 141.

[56]Perrin, R.K. et al. *Some Effects of the U.S. Plant Variety Protection Act of 1970,* Economic Research Report No. 46, Department of Economics and Business, North Carolina State University, North Carolina, August 1983. The study showed that a decrease in research expenditure per $1000 of sales reported by 56 firms during 1970 - 1979: hybrid corn (39.32 to 37.83), hybrid sorghum (49.35 to 43.33), soybeans (88.43 to 41.00), vegetables (51.94 to 47.59)

Because of the lack of solid evidence supporting the direct connection between an increase in private investment in plant breeding of some varieties and PVR protection as well as a decrease in the investment in plant breeding of some varieties, it cannot be concluded that the protection stimulates private investment in plant breeding.[57]

The experiences in some Latin American countries

In 1994 economic effects of PVR protection were studied in five Latin American countries: Argentina, Chile, Columbia, Mexico and Uruguay.[58] The economies in these countries are mainly agriculture-based, and seed industries are dominated by multinationals. In each country, the State plays a vital role in the establishment of seed industries in the early stages of development and the private sector only

---

[57]Lesser's recent study on the valuation of the US plant variety protection certificates concludes: "Hedonic pricing is used to value certificates of plant variety protection for soybean seed in New York. The estimated price premium of 2.3 per cent (0.7 cents/ lb) is low, and another indicator that US Plant Variety Rights protection likely provides inadequate incentives for breeding investment. Soon the Congress will decide on amending the Plant Variety Protection Act to strengthen protection. The current results suggest strengthening is needed, but additional study is required to determine if the proposed amendments are optimal." (Lesser, W. *Valuation of Plant Variety Protection Certificates,* Department of Agricultural Economics, New York State College of Agricultural and Life Sciences, A Statutory College of the State University, Cornell University, New York, June 1993.

[58]The study was undertaken by Walter Jaffe and Jeroen Van Wijk under responsibility of the Technology Generation and Transfer Programme of the Inter-American Institute for Co-operation in Agriculture, Costa Rica and the Department of international Relations and International Public Law of the University of Amsterdam. (Jaffe, W. et al. *The Impact of Plant Breeders' Rights in Developing Countries: Debate and Experience in Argentina, Chile, Columbia, Mexico and Uruguay,* Inter-American Institute for Co-operation on Agriculture, University of Amsterdam, February 1995 (unpublished).

enters the market because of the state initiatives offered and a potential market. Local industries focus on open-pollinated varieties whereas multinational firms specialise in hybrids.[59] The development of seed industries in these countries goes beyond stage 3 of the Douglas' general model of seed industry development.[60]

---

[59]Mooney has suggested that there are a number of biases in corporate breeding. The hybrid bias, amongst other things, affects the direction of breeding programmes. Two main advantages are:

(1) They offer rapidly increased crop yield and a vigour of real value to farmers.

(2) They do not breed true to their lineage, and produce either useless or sterile seeds. Farmers are unable to save seed to grow in the following season and therefore return to the market place. The increased seed cost facing farmers is presumably offset by increased productivity.

(Mooney, P.R. *Seeds for the Earth: A Private or Public Resource?*, Canadian Council for International Co-operation, Ottawa, Canada, 1979, p. 84)

[60]According to Douglas, J.E., the development of seed industry can be divided into four stages:

- Stage 1 where no seed industry exists because of no improved varieties;
- Stage 2 where farmers rely on varieties developed by government;
- Stage 3 where the private sector begins to play a vital role in plant breeding activities; and
- Stage 4 where farmers mainly rely on varieties developed by the private sector.

(Douglas, J.E. (ed.),*Programas de Semillas. Guia de planeacion y manejo*, Series CIAT 09SSe-6(82), 1982; cited in Jaffe, W. et al. *The Impact of Plant Breeders' Rights in Developing Countries: Debate and Experience in Argentina, Chile, Columbia, Mexico and Uruguay*, Inter-American Institute for Cooperation on Agriculture, University of Amsterdam, February 1995 (unpublished))

It may be observed that the economic impact of PVR protection may increase as the development goes further or where the private sector plays an increasing role in the improvement of plant varieties. In the first stage, obviously the protection has no impact since there is no variety eligible for the protection. In the second stage, the protection may have a negligible effect because normally such varieties are distributed to local farmers without charge. Particularly, in developing countries whose economies are agriculture-based, their governments tend to establish national policy to support local farmers; and the distribution of improved varieties to farmers is one important agenda in the policy. In stages 3 and 4, the impact may become more noticeable. The PVR monopoly may be used to recoup the investment made by the private sector in plant breeding programmes.

Nevertheless, this observation has proven untrue, as illustrated by a number of studies mentioned earlier.

Private sectors, particularly in Argentina and Uruguay, were dependent on the collection of germplasm in public institutes; the access to non-modified germplasm was free whereas modified material was accessible through exchange agreements based on the principle of reciprocity.

The study concluded that PVR protection had a negligible impact on: (1) private investment in plant breeding, (2) changes in plant breeding in public institutes,[61] and (3) the access to germplasm of public institutes. The economic impact of protection in these countries may be undermined by the fact that investment decisions by the industries are mainly determined by the market and the investment climate; as business executives in Argentine seed industries revealed that their investment decision did not depend on the presence of PVR protection but rather economic policies and necessity to improve their competitiveness in the market. Such competitiveness may be enhanced by various means, including marketing strategies. Another important fact is that most seed industries engage in hybrid production and the instability of hybrids prevents the use of hybrid seeds for further seed production.[62]

Local industries in Argentina claimed that they were the main beneficiaries of the protection;[63] nevertheless, it may be observed that PVR protection itself was not

---

[61] An expected change is the diversion of public plant breeding direction as a result of:
(1) Increasing interest of private breeders in plant breeding which has been carried out by public institutes; or (2) The opportunity of commercialisation of protected varieties. This would require public breeding stations shifting their interest towards protected varieties whereas basic research will gain less attention.

[62] See Chapter 1 for more details.

[63] The benefit is the decline of the black market; in this market, seed dealers purchase grain from farmers and sell this grain as propagating material, i.e. seed, to other farmers. In 1989, 90 per

the main reason for the success. The decline of the black market mainly resulted from the combination of the effective seed regulation and the establishment of Associación Argentina de Protección a las Obtenciones Vegetales (ARPOV)[64] and Instituto Nacional de Semillas (INASE). Effective seed regulations render efficient seed markets by protecting farmers' interests; basically, the regulations require that seeds sold in the market must meet the statutory standards. ARPOV represents national seed companies, public institutes, universities, co-operatives and multinational firms and the association was responsible for collective control. The strength of ARPOV came from the mutual cooperation between members in imposing commercial sanctions in case of unauthorised seed production, i.e. a licensee who does not respect the rights of a member will automatically lose his opportunity to enter into a licensing contract with other members. INASE, which is under the Ministry of Agriculture, is responsible for detecting infringements; it has a policing power to inspect and analyse seed that is transported or offered for sale in the country. Since the commencement of inspection in 1993 until 1994, 163 fines had been imposed for violations of the rights.[65]

---

cent of the Argentine seed dealers were not registered and in 1994, this figure was reduced to 40 per cent. Nevertheless, royalty payment was not the main reason for avoidance of registration. Dealers' main interest was to escape from tax assessment; taxes constituted a far higher burden for dealers than royalties. It is questionable whether the black market will exist if the tax burden is low.

[64]The association has established a successful administrative system to control the licensing of seed production and developed a licensing contract which requires: registration and protection of varieties; an agreement between the breeder and the producer; a licensee to offer information on request; penalties for non-compliance with seed regulation; a licensee to maintain a seed book; and a licensee to authorise ARPOV to examine audits at the licensee's premises.

[65]When the infringement is established, INASE has a power to impose a fine and sanctions. A fine can be between 200-1.000,000 US$ and sanctions include closing down of establishments, temporarily or permanently.

Empirical evidence in both developed and developing countries that PVR protection encourages industries to make investment in plant breeding activities is poor. Even though the history reveals an impressive increase in plant breeding activities after the passage of the legislation, no one could confirm that such an increase was directly associated with the protection; and some scholars suggested that it might result from other factors, including the growing market and technological development. The lack of conclusive evidence therefore casts doubt on the economic effects of protection.

CHAPTER 7

PVR PROTECTION AND PUBLIC-INTEREST ISSUES

Introduction

The previous chapter focused on the economic effects of PVR protection on the development of the seed business in Thailand, since its development is fundamental to the country's economic growth. Nevertheless, the study would not be complete if other aspects of the protection are to be ignored.[1] This chapter, therefore, will focus on the wider public interest aspects of PVR legislation, in particular seed price, technological development and the environment.

It is hoped that the information in this chapter will assist the Thai government to determine a system of PVR protection which strikes the most appropriate balance between public and private interests.[2] The legislation should be designed to

---

[1]Professor Dworkin is of the opinion: "But plant breeders' rights are no longer of interest to plant breeders alone: the social and political climate of today, particularly internationally, is quite different to what it was two decades ago. The patent system generally has come under close scrutiny in many countries and its public benefit has been questioned. The plant breeders' rights system, in particular, has become embroiled in international controversy on social, political and economic grounds." (Dworkin, G. "The Plant Varieties Act 1983" [1983] European Intellectual Property Review 270, at 270)

[2]Professor Cornish states: "As a regime is developed for protecting a form of intellectual property a number of basic decisions have to be made: What types of subject-matter are to be included? Is the right to be conferred only upon application to a government office? How long is it to last? Is it to be a right good only against imitators (as with copyright and unregistered designs), or is it a "full monopoly" that even affects independent devisors of the same idea (as with patents for inventions, registered designs and trade marks)? The operative rules vary because each type of subject-matter calls for a different balance of public and private interests-the interests of the society as a whole in its economic and cultural development, and the interest of the individual to

promote the overall economic development of the country, rather than that of one particular economic sector or interest group.

---

secure a "fair" value for his intellectual effort or investment of capital or labour." (Cornish, W.R. *Intellectual Property,* 3rd ed., Sweet & Maxwell, London, 1996. p. 11.)

7.1. The effect of PVR protection on seed price

In the previous chapter, the positive economic implication of PVR protection, its investment-incentive role, was discussed. The economics of PVR protection, however, are not wholly positive; the protection has been a controversial topic amongst PVR sceptics who have expressed fear about its undesirable consequences. Much concern centres on the impact on seed price.[3] The imminent introduction of PVR legislation in Thailand inevitably has attracted criticism from local experts that it would raise seed prices.[4]

The main argument expressed by critics in Thailand to support their concern about the effect of PVR on seed price is that PVR proprietors, who are expected to be multinationals,[5] will exercise their monopoly power derived from PVR to raise seed prices. The relationship between monopoly and the price mechanism has been

---

[3]How does seed price enhancement affect public interests? The possibility of seed price enhancement may seem to be a distant problem for the public since only a particular group of people are the main seed users, mainly farmers. But a chain reaction effect should not be overlooked. Any increase in seed prices may have immediate economic implications for agricultural producers. An increase in seed prices may result in a rise in agricultural product prices, since producers (including farmers) will not be able to absorb this rise in production costs without being passed on to the end user, i.e. the public. Another problem is farmers with limited financial resources may not be able to afford to purchase seed.

[4]Professor Rapee Sakarik (an outstanding plant breeder who has an influence on the Thai agricultural development in many respects) and Mr. Charoen Kumpeeraparp (a lawyer from the Thai Centre for Environmental Law) have expressed their concern in a local newspaper that the introduction of PVR protection would have undesirable effects, particularly seed price rises. (*Prachachart Turakit*, No. 2551(1751), 26th-29th June 1994)

[5]The 1995 survey in Appendix 6/1 shows that business executives in these companies submitted that they were likely to file a PVR application for their varieties.

investigated in numerous studies. Nevin's theoretical analysis considers price mechanism in three situations:[6]

(1) Price under perfect competition where a producer is unable to exert a perceptive influence on the market price.[7]

(2) Price under monopoly where a single producer controls the entire output of a certain commodity and therefore is able to affect the market price by changes in his output.

(3) Price under imperfect competition where a producer can exert a certain degree of influence on the market price.[8]

Nevin's analysis reveals that a producer can exercise his monopoly power to exert influence on the market price of his commodity. He suggests that monopoly power can be derived from various sources, including:

---

[6]Nevin, E. *Textbook of Economic Analysis,* 5th ed., MacMillan, London, 1985, pp. 149-173.

[7]The state of perfect competition implies the absence of monopoly power, i.e. the absence of any power on the part of any individual firm or consumer to influence market prices. In it certain things are assumed about each of the two groups of individuals involved in economic exchange: producers and consumers. So far as the supply side is concerned, it is assumed that the number of producers competing with one another is so large that no single producer can exert a perceptible influence on the market price through variations in his output.

[8]It is almost impossible to discover a single commodity in the actual world which is exchanged under conditions of perfect competition, and equally difficult to discover instances of pure monopoly. The reality, as always happens, is to found somewhere between these two extremes; the vast majority of markets display characteristics of both monopoly and competition, the monopoly element tending to dominate in some, that of competition in others. This situation is referred to as imperfect competition. In reality there are usually several producers of the same commodity but not an infinite number of them, with the result that each producer can exert a significant influence on total supply through changes in his own output, and therefore influence price perceptively; at the same time, some degree of competition exists.

(1) The control of one or more factors of production. In particular, the ownership of deposits of raw materials may give an unchallengeable position to a firm in producing a commodity for which those raw materials are essential.

(2) Legal restriction on the entry of potential competitors into an industry, e.g. intellectual property protection.

(3) Financial factors. Highly capitalistic industries require enormous outlays on capital equipment before production can be carried out on the level necessary to compete with an established firm; as a result, potential competitors with limited financial resources may find it virtually impossible to enter the industry.

But is PVR likely to give its proprietor monopoly power? Legal commentators have doubted that intellectual property protection affects the price of a commodity.[9] The effect of PVR on seed price, in particular, has been investigated

---

[9]Professor Cornish, for example, takes the view that to the extent that intellectual property is capable of generating market power, it offers its owner (and his associates) the opportunity to reduce output and raise prices. What it does not bring about is the condition in which the monopolist behaves as though he were the only competitor on the market. Yet the more naive arguments in favour of one or other exclusive often imply that this alone will be the effect of according that right sought. This intermediate condition can indeed be aimed at: through mechanisms such as direct price control, or though one or other of the dorms of statutory or compulsory licensing. Accordingly, it is no surprise to find that economists who doubt the justifiability of unconstrained intellectual property turn to the compulsory license as moderating technique. (Cornish, W.R. *Intellectual Property*, 3rd ed., Sweet & Maxwell, London, 1996, p. 31)

Justice O'Connor in *Jefferson Parish Hospital District No. 2* v. *Hyde* (1984) US 2 (United States Supreme Court), at 16 pertinently noted: "A common misconception has been that a patent or copyright, a high market share, or a unique product that competitors are not able to offer suffices to demonstrate market power. While each of these factors might help give market power to a seller, it is also possible that a seller in these situations will have no market power: for example, a patent holder has no market power in any relevant sense if there are close substitutes for the patented product. Similarly, a high market share indicates market power only if the market is

by several scholars, mainly in the USA, and these studies suggest that the affect on price is negligible.[10] Furthermore, from a legal perspective, PVR legislation itself

---

properly defined to include all reasonable substitutes for the product." In later cases, courts refused to accept that there was any absolute presumption of market power where a product is patented or protected by copyright or a trade mark. See, for instance, *Hennessy Industries Inc* v. *FMC Corporation* (1985) 779 F2d 402 (United States Court of Appeals, Seventh Circuit); *Will* v. *Comprehensive Accounting Corporation* (1986) 776 F2d 665 (United States Court of Appeals. Seventh Circuit); *Mozart Company* v. *Mercedes-Benz of North America Inc* (1987) 833 F2d 1342 (United States Court of Appeals, Ninth Circuit); *Technicon Instruments Corporation* v. *Alpkem Corporation* (1989) 866 F2d 417 (United States Court of Appeals, Federal Circuit).

Also Baenziger suggests that the term "monopoly" commonly is used in more than one sense. Definitions of monopoly can range from exclusive control of an irreplaceable commodity or service in a particular market, down to simple exclusive possession or control of a unique but not irreplaceable piece of property. With the first kind of monopoly, sometimes called "a true monopoly," there is the opportunity to set prices, regardless of the usual supply and demand forces. With the second type, at the other end of the scale, market forces are the predominant lever for setting prices and determining profitability. Intellectual property protection for plants, exclusive ownership of some aspects of plants, tends to be on materials that are at neither end of this continuum. Owners cannot set prices with complete independence because their properties can be replaced by similar ones in the hands of others, but on the other hand, owners can prohibit others from using (selling) their protected products and so have an exclusive right to market those unique products as best they can. (Baenziger, P.S. et al. (eds.) *Intellectual Property Rights: Protection of Plant Material,* Crop Science Society of America et al., Madison, USA, 1993, p. 22)

[10]In 1983 Perrin concluded: "There is no evidence that the protection has resulted in any price enhancement even in non-hybrid crops that the possibility of PVPA impacts is relatively high, compared to hybrid crops" (Perrin, R.K. et al. *Some Effects of the US Plant Variety Protection Act of 1970,* Economics Research Report No. 46, Department of Economics and Business, North Carolina State University, North Carolina, 1983) Three years later Butler and Marion concluded in their study: "Increase in prices, market concentration and advertising and declines in information exchange and public plant breeding - the feared costs of PVPA - have either been nil or modest in nature." (Butler, L.J. et al. *The Impacts of Patent Protection on the US Seed Industry and Public Plant Breeding,* North Central Region research publication 304. Research

also contains measures against undue monopolisation. A compulsory licence scheme, for instance, is designed to balance the interest between the right proprietor and the public. Despite these empirical studies, it would be unwise to assume that Thailand should expect a similar outcome. Further analytical work is necessary to investigate the impact on the Thai agro-economy.

Would PVR protection give monopoly power to a company in the Thai seed business? Even though the Thai seed market may be seen as oligopolistic. dominated by a few multinationals, the competition is high since each firm develops its own varieties in order to attract customers. Table 5 in Chapter 5 shows that although competing firms are producing seed of the same plants, each firm tends to concentrate on a different varieties (particularly vegetables). Varietal interchangeability is a noteworthy feature of the Thai seed market, will individual farmers being prepared to substitute one variety for another. As a consequence it is difficult for each individual firm to exert undue influence on the market price of seed.[11] The introduction of PVR legislation will not change this situation since

---

Division, College of Agriculture and Life Sciences, University of Wisconsin, Madison, 1985, p. 79)

[11]The impact of product substitution on price has been discussed by a large number of experts. For example, Professor Cornish suggests: "A market for goods has to be conceived in terms of all the goods that consumers will treat as substitutes for one another: will they switch from one to another if, for instance, the price of the first is raised? The extent to which purchasers want the product that is the subject of intellectual property and not some alternative is often difficult to determine." (Cornish, W.R. *Intellectual Property,* 3rd ed., Sweet & Maxwell, London, 1996, p. 30)

Robinson explains that there is frequently some other commodity which can be substituted for a particular product, and it is the ease with which this can occur. and the willingness of consumers to switch from one product to another, which determine how strong a monopoly a producer may have. (Robinson, D. *Introduction to Economics,* ICSA Publishing, Cambridge. 1986, p. 79)

these firms have developed their own varieties which may be eligible for PVR. It may be argued that strong PVR protection, particularly under the 1991 UPOV text, will limit the degree of varietal interchangeability, by extending PVR to essentially derived varieties. The extended protection strikes at the so-called cosmetic breeding.[12] However, plant breeding programmes in seed companies in Thailand do not involve any form of cosmetic breeding.[13]

Moreover, seed pricing is Thailand is subject to certain regulatory arrangements. One way of inducing a monopolist to produce optimum output would be to regulate the maximum price at which the product could be sold. Commodity pricing in Thailand is subject to a number of factors, including government regulations and market mechanisms. In general, the pricing of certain commodities (usually necessities) is controlled by the Department of Internal Trade of the Ministry of Commerce under the 1979 Price-Fixing and Anti-Monopoly Act. Under Sections 23, 24 and 25, certain commodities, such as seeds, are categorised as controlled commodities and their owners are required to inform a Consumer Protection Committee of their prices. The Office of the Central Committee of Price Fixing and Anti-Monopoly of the Department of Internal Trade monitors business conduct nationwide. The seed price of certain varieties is monitored also by the Ministry of Agriculture. For example, the Ministry has used the prices of open-pollinated seeds (which are in public hands) as the benchmark for pricing hybrid

---

[12]See Chapter 2 for more details.

[13]See the 1995 survey in Appendix 6/1.

seeds; the price of hybrids cannot exceed the price of open-pollinated seeds plus the marginal gain from using hybrid seeds.[14]

When the abuse of monopoly is substantial, the government may take action to ensure adequate protection for consumers; for example, the government may take responsibility for seed production in order to ease problems of seed shortage.

Accordingly, whilst it is possible it seems unlikely that proprietors will use PVR to raise seed price.

7.2. The effect of PVR protection on technological development

Technological advances in plant breeding and seed production can take the form of either process or product development. Process development involves plant breeding techniques which cannot be protected by PVR[15] (only plant varieties are protectable). Product development focuses on breeding new varieties. For many years, plant breeders have been working on the development of new varieties which are beneficial to farmers and consumers. In developing new varieties, physical access to germplasms (plant materials) is crucial[16] because of the unique

---

[14]Brenner, C. *Biotechnology and Developing Country Agriculture: The Case of Maize*. Development Centre of the Organisation for Economic Co-operation and Development, France, 1991, p. 84. The marginal gain is set by agreement between the government and industries.

[15]In some countries, these techniques are eligible for certain forms of intellectual property rights. For instance, The EPO Technical Board of Appeal in *LUBRIZOL/ Hybrid plants* [1990] European Patent Office Reports 173 allowed a patent application directed to a process for rapidly developing hybrids and commercially producing hybrid seed. The said process involved selecting heterozygous parent plants, crossing and cloning parent plants.

[16]Chapter 1 shows that selection of germplasm is an important step of plant breeding.

nature of living organisms. With existing knowledge and techniques, scientists have learnt the structure of living organisms at the molecular level; nevertheless, they are not yet able to construct living organisms de novo, from known basic components.[17] Hence, breeders have to rely on existing varieties to develop new varieties.

How does PVR affect access to plant materials of protected varieties? Whilst seed companies in Thailand believe that PVR will increase the inward flow of new varieties from abroad, some sceptics say that PVR will obstruct access to plant materials of protected varieties.[18]

Does the absence of PVR discourage foreign breeders from sending their varieties to Thailand? Empirical evidence in some countries has shown isolated cases where PVR affects the access to foreign varieties. It has been reported that the absence of PVR protection was amongst the main reasons that Australian companies were denied access to some overseas varieties.[19] Jaffe's study[20] reveals that several

---

[17]Bent provides that biotechnological inventions involve manipulation of living material with the object of changing the properties of that material. Biotechnological inventions are generally not assembled from simpler, well-defined elements, into similarly well-defined structures of greater complexity according to a concise set of instructions. (Bent, S.A. et al. *Intellectual Property Rights in Biotechnology Worldwide,* Stockton Press, New York, 1987, p. 7)

[18]See the 1995 survey in Appendix 6/1 and Professor Rapee Sakarik's interview in *Prachachart Turakit,* No. 2551(1751), 26th-29th June 1994.

[19]The varieties include grapes (Germany), rapeseed (France), perennial rye grass, cherries, barley (UK), and garden beans, cotton, strawberries, pome fruits, peaches, nectarines and apricots (US). (Senate Standing Committee on National Resources, *Plant Variety Rights,* Australian Government Publishing Service, Canberra, 1984, p. 43.)

[20]Jaffe, W. et al. *The Impact of Plant Breeders' Rights in Developing Countries: Debate and Experience in Argentina, Chile, Columbia, Mexico and Uruguay,* Inter-American Institute for Cooperation on Agriculture, University of Amsterdam, February 1995. (unpublished)

breeding and cultivating companies involved in the survey in Columbia and Chile could cite one or two examples of European or North American varieties that were refused to them because of the lack of effective PVR systems in their countries. However, some multinational corporations, e.g. Pioneer, submit that PVR protection is not an important factor for the release of their new varieties to their subsidiaries in other countries.[21]

The refusal of access to foreign varieties noted in the Jaffe study took place between unrelated companies. There was no evidence that parent firms in one country refused to supply germplasm or new varieties to their subsidiaries in those countries. Chapter 5 reveals that seed production and commercialisation in Thailand is dominated by multinational corporations. Even though the largest seed company is Charoen Pokphand, a local firm that specialises in the production and commercialisation of a wide range of agriculture products, the firm has established a technology partnership with a foreign company, Dekalb. Most foreign varieties have been supplied by these parent companies and technology associates. These companies continue to send their varieties to Thailand with or without PVR protection as long as the market for their varieties remains profitable. For instance, there is a constant increase in seed of foreign varieties, especially vegetables, in the seed market in Thailand.

---

[21]Kalman, L. et al. "The Role of Plant Breeders' Rights in the Transfer of Technology"; in *Seminar on the Nature of and Rationale for the Protection of Plant Varieties under the UPOV Convention,* organised by the International Union for the Protection of New Varieties of Plants in cooperation with the Government of the Republic of Hungary, Budapest, Hungary, 19th-21st September 1990, p. 101.

Furthermore, before a breeder releases his variety to be exploited in another country, he is apt to ask or consider whether the variety will be misappropriated: and therefore he will be unable to recoup his investment in developing variety. If the misappropriation causes, or is likely to cause, him an economic loss, intellectual property protection for plant varieties will play a vital role since the protection makes illegal the unauthorised use or exploitation of plant varieties. Chapter 6 shows the lack of misappropriation of plant varieties in Thailand. Accordingly, the absence of PVR protection does not discourage the inward flow of new varieties from abroad.

Will PVR protection obstruct the access to plant materials of protected varieties in Thailand? As mentioned in Chapter 2, the 1978 and 1991 UPOV Conventions recognise the importance of free access and use of plant materials of protected varieties, by incorporating a breeder's exemption into the texts. This means that anyone can get access to and use plant materials of protected varieties to develop new varieties without the risk of infringing PVR. Even though a breeder's exemption exists in both texts, the later text narrows the scope of the exemption. Whilst this does not deter the breeding of new varieties from protected varieties, under only the 1991 text the commercial exploitation of some new varieties may require a licence from a breeder of the initial varieties.[22] Therefore, legally considered, PVR protection conforming with either the 1978 or 1991 Conventions does not obstruct the free access to plant materials of protected varieties.

---

[22]These new varieties must not be:

(1) varieties which are essentially derived from the protected variety, where the protected variety is not itself an essentially derived variety.

(2) varieties which are not clearly distinguishable from the protected variety.

(3) varieties whose production requires the repeated use of the protected variety.

Moreover, throughout the history of plant breeding and seed production in Thailand, it has never been reported that plant materials of commercially valuable varieties were accessible amongst seed companies. Business executives in seed firms in Thailand said that they did not want to release their plant material - the most valuable asset - to potential competitors.[23] When they were asked whether they would release their varieties, particularly parent lines, if PVR protection was available in the country, the most common answer is that they were be likely to seek PVR protection for their varieties. They would nevertheless prevent their competitors from gaining access to and trying to improve their varieties lest the new varieties should compete with their own. For this reason, access to plant materials of protected varieties will remain severely restricted, and it is most unlikely that the introduction of PVR protection would change this situation.

7.3. PVR protection and environmental concerns

Environmental concerns have been growing in many countries, particularly the USA and Europe. Global consciousness of environmental issues is evident since the world has witnessed several environmental disasters. The environmental issues are increasingly in the mainstream of national and international politics, rather than on the sidelines.[24] Many international conventions and agreements concerning this

---

[23]See the 1995 survey in Appendix 6/1.

[24]Vaughan Lowe and Dominic McGoldrick in series editors' preface on Sands, P. *Principles of International Environmental Law: Volume I Frameworks, Standards and Implementation.* Manchester University Press, Manchester, 1995, p. xi.

subject have been established with the prime aim of tackling and preventing environmental problems.[25]

The environmental aspects of intellectual property protection have generated considerable controversy.[26] Patent and PVR protection have been criticised by some environmentalists for hastening environmental disasters.[27] Therefore, the

---

[25]They are, for instance, the 1991 Convention on Environmental Impact Assessment in a Transboundary Context, the 1992 Convention on Biological Diversity, the 1993 Convention on Civil Liability for Damaging Resulting from Activities Dangerous to the Environment, the 1993 Agreement Concerning the Establishment of a Border Environment Co-operation Commission and a North American Development Bank.

[26]See, for example, *People, Plants, and Patents: The Impact of Intellectual Property on Biodiversity, Conservation, Trade, and Rural Society,* International Development Research Centre, Ottawa, Canada, 1994, p. xiv. The author states: "A number of factors are coming together to make intellectual property and biodiversity important issues for humanity. First, one of the most persistent and growing political realities of the past quarter-century is public awareness of environmental degradation. Although the "popularity" of environmental issues can be seen to wax and wane somewhat before and after major events, such as the Earth Summit of 1992 (the United Nations Conference on Environment and Development, UNCED), there is an intensifying awareness in global civil society that all is not well and that strong actions must be taken. We believe there is indeed cause for alarm and nowhere more so than for the food crops and medicinal plants that nurture us."

[27]See, for instance, *PLANT GENETIC SYSTEMS/ Glutamine synthetase inhibitors* [1995] European Patent Office Reports 357 where Greenpeace UK submitted an opposition to a European patent for herbicide resistant plants on the basis that the invention was environmentally damaging. The Greenpeace arguments were that the invention would result in an increased use of herbicides and that the release of genetically engineered organisms into the environment posed unacceptable environmental risks. Nevertheless, these arguments were rejected by the EPO.

Nijar in his paper circulated in the Biodiversity Convention meeting in October 1993 states: "Public accountability by researchers and industry for the hazards of biotechnology which is protected by IPRs will accordingly be eroded because IPRs as they are globally promoted are primarily designed for the interest of private industry, and hides the ignorance about the

issue of PVR protection and environmental concerns should not be under-estimated.[28] Even though at present the environmental issues concerning biotechnology do not attract much public interest in Thailand, it is anticipated that environmental concerns will in the near future be discussed amongst local experts. Thai environmentalists, in recent years, have played an increasingly active role in the political arena and their actions could lead to political conflict and public awareness.[29]

Two main concerns with regard to PVR legislation are unpredictable harm from the release of new plant varieties and biodiversity erosion, both of which have attracted the attention of academic environmentalists in Thailand. How well-founded are these concerns?

---

ecological and health impacts of new technologies." (Nijar, G.S. et al. *Intellectual Property Rights: the Threat to Farmers and Biodiversity*, Paper circulated at the Biodiversity Convention meeting of the Inter-governmental Negotiating Committee in Geneva, 11th-15th October 1993.)

[28]Professor Dworkin states: "The various arguments which have been advanced by the opponents of plant breeders' rights have been criticised as containing factual and technical errors that can do nothing but mislead, but, whatever their validity, they have captured the minds of many opponents of plant variety rights and must be refuted authoritatively if they are to cease to be of significance when countries throughout the world decide as a matter of policy whether or not to join, or adhere to, the UPOV system." (Dworkin, G. "The Plant Varieties Act 1983" [1983] European Intellectual Property Review 270, at 270.)

[29]In recent years, a number of projects (for example, the Bangkok Sky Train construction, the Pasak Dam Foundations and the Pak Mool Dam Construction projects) have been terminated or deterred as a result of political pressure from environmentalists.

7.3.1. PVR protection and the release of new plant varieties

At present, the public is no longer unfamiliar with possible dangers of modern technology since they are illustrated in various forms of accessible media, for instance, the film "Jurassic Park" acquainted audiences with the risks of genetic engineering. Environmentalists have expressed fears that certain biotechnological products, such as genetically engineered organisms (GMOs), would harm the environment.[30,31] Genetic engineering is becoming a common tool in plant breeding; the past decade has witnessed a number of transgenic plants, including tomato, tobacco and potato. These plants have been developed for various

---

[30]It was reported in New Zealand that two non-pathogenic microorganisms were combined and applied to tree seedlings in order to enhance their ability to fix nitrogen from the air. The resulting new organisms expected to be non-pathogenic were in fact pathogenic and killed the seedlings to which it was applied. (Valiante, M.A. "Biotechnology and the Environment: A Regulatory Proposal" [1985] Osgoode Hall Law Journal 359.)

[31]Environmentalists have expressed certain concerns as to risks from the release of GMOs in the field of agriculture which include:

- Risk of transfer of herbicide resistance to weeds. There is a risk of cross-pollination from a herbicide resistant transgenic crop switching herbicide resistance to weedy relatives growing nearby, and generating more aggressive weeds.
- Risk of increased use of toxic pesticide. Use of herbicide tolerant crops is likely to encourage greater use of chemical herbicides. Herbicide tolerance is being sought by the industry for a number of older, more toxic and more persistent pesticides.
- Risk of development of pest resistance to biopesticides. A toxic protein produced by *B. thuringgiensis* (*Bt*) that kills insects, is being used as a biopesticide by engineering the gene for that protein into crops. A fear is that insects may become resistant to the toxic protein.
- Risk of 'knock on' effects on ecosystems. A transgenic biological control organism might unexpectedly predate a non-target herbivore, allowing weeds to proliferate which had once been controlled by that herbivore. (World Wild Fund for Nature (WWF), *The Need for a Biosafety Protocol as Part of the Biodiversity Convention, A Background Paper for the first Conference of Parties to the Convention on Biological Diversity*, Nassau, Bahamas, 28th November - 9th December 1994)

purposes, such as disease resistance, improved quality or productivity. It has been estimated that the potential global market for seeds of genetically modified varieties will reach US$ 6.8 billion by the end of this century.[32] This estimate reflects the increasing release of GMOs into the environment. Certain transgenic plants have been released into the environment and some have been marketed: the first release of a genetically engineered plant took place in 1986 in Belgium and ever since, the number of releases has grown apace, with a recorded total at the end of 1992 of 860 and OECD data showed that by the end of November 1992, 200 transgenic crops had entered field trials.[33]

The connection may be explained by the theoretical roles of PVR protection: incentive-to-invent and incentive-to-innovate.[34] PVR protection encourages breeders to be more active in plant breeding activities for foreseeable financial return; as a consequence of increasing activities, more new varieties are expected. The fear is that an increase in new varieties will cause unpredictable environmental disasters.

---

[32]Beaumont, P. "Release of Genetically Modified Organisms" [1993] 2 Review of European Community & International Environmental Law 182.

[33]World Wild Fund for Nature (WWF), *The Need for a Biosafety Protocol as Part of the Biodiversity Convention, A Back Ground Paper for the first Conference of Parties to the Convention on Biological Diversity,* Nassau, Bahamas, 28th November - 9th December 1994.

[34]The author uses the theoretical roles of patent protection (proposed by Schumpeter) as a model for those of PVR protection because of the similarities in construction between patent and PVR protection.

7.3.2. PVR protection and biodiversity erosion

Scientists have defined the term "biodiversity"[35] as the variability amongst living organisms from all sources and the ecological systems of which they are a part; this includes diversity within species, between species and of ecosystems.[36] In simple terms, biodiversity means all species of plants and animals, their genetic material, and the ecosystems of which they are a part.

During the last decade many environmental concerns have focused on the issue of biodiversity. Environmentalists claim that the world is facing a global biodiversity crisis, i.e. a drastic decrease in biodiversity. Humans are claimed to be the major cause of the crisis; the estimation in 1995 shows that more than half the habitable surface of the planet has already been altered mainly by human activities.[37] Environmentalists suggest that human activities which cause the loss of biodiversity include deforestation and plant breeding programmes.[38] At present,

---

[35]The term "biodiversity" was coined by Walter G. Rosen in 1985 for the first planning meeting of the "National Forum on Biodiversity" held in Washington DC in September 1986. (Heywood, V.H. (ed.) *Global Biodiversity Assessment* (published for the United Nations Environment Programme) Cambridge University Press, Cambridge, 1995, p. 5)

FAO defines the term "biodiversity" as the variety of the world's organisms, and the assemblages (ecosystems) they form. (Document CPGR/91/9, submitted to the fourth session of the Commission on Plant Genetic Resources (15th-19th April 1991: Biological Diversity and Plant Genetic Resources)

[36]Bisby, F.A. "Characterisation of Biodiversity"; in Heywood, V.H. (ed.) *Global Biodiversity Assessment* (published for the United Nations Environment Programme) Cambridge University Press, Cambridge, 1995, p. 27.

[37]Hannah, L. et al. "Global Priorities" [1995] 45 BioScience 122.

[38]Dr. Dorsman of the Wageningen Gene Bank in the Netherlands laid the blame at the feet of urbanisation, tree-cutting, overgrazing and the introduction of new high-yielding Green

plant breeders use the very narrow gene pool of plants in order to develop uniform cultivars. This would not be much of a problem if the uniformity of plants were not an important factor in the interactions between plants and their pathogens, leading to epidemic outbreaks of disease.[39] Humans have learnt several painful lessons of the dangers of genetic uniformity.[40]

PVR legislation has been accused of increasing biodiversity erosion.[41] Commentators have put forward two main theoretical possibilities:

Revolution varieties. (Mooney, P.R. *Seeds of the Earth: A Private or Public Resource?*, Canadian Council for International Co-operation, Ottawa, Canada, 1979, p. 15.)

[39]Hawksworth, D.L. et al. "Magnitude and Distribution of Biodiversity"; in Heywood, V.H. (ed.) *Global Biodiversity Assessment* (published for the United Nations Environment Programme) Cambridge University Press, Cambridge, 1995, p. 133.

[40]See, for example, the Irish Potato Famine in the late 1840s and the epidemic of coffee rust in Sri Lanka, India, Java, Malaysia, the Philippines and many African countries. (Mooney, P.R. *Seeds of the Earth: A Private or Public Resource?*, Canadian Council for International Co-operation, Ottawa, Canada, 1979, pp. 12-13.)

[41]See, for example:

Mooney, P.R. *Seeds of the Earth: A Private or Public Resource*, Canadian Council for International Co-operation, Ottawa, 1979, p. 70. The author states: "In summary, the legal requirements of PVR encourage phenotypic uniformity which increases crop vulnerability and eliminates varieties. The European experience indicates that these eliminated varieties are often lost to humanity. Secondly, 'protection' provides the necessary profit security to encourage multinationals to move into the seed business. To maximise profit, these giant corporations direct their research dollars to hybrid development thus increasing crop uniformity and genetic vulnerability. Finally, to maximise the product life cycle and profit of new varieties, the industry markets its seeds in the Third World- increasing erosion in the Vavilov Centres and the danger of crop epidemics."

In *People, Plants, and Patents: The Impact of Intellectual Property on Biodiversity, Conservation, Trade, and Rural Society*, International Development Research Centre, Ottawa, Canada, 1994, p. 25, the author states: "When farmers look to distant markets to sell their surplus crop, they often sow different, more commercially viable varieties. Government

(1) The legislation lays down three main statutory requirements: distinction, uniformity and stability.[42] The requirement of uniformity has been controversial; some commentators claim that it would increase phenotypic (characteristic) uniformity of new plant varieties which would cause (or speed up) biodiversity erosion.[43]

(2) The second possibility has been described by the Crucible Group. It is suggested that PVR protection enhances incentives for commercial plant breeding, shifting efforts towards the development of varieties with the largest market potential, that is, major crops that are widely adapted across large areas and with characteristics that best meet the needs of commercial farmers and the marketing and processing industries. PVR means that seed companies obtain a higher return on protected varieties than on unprotected traditional varieties. There is a strong tendency to make only minor changes in the market leader and rely on marketing to sell the variety as something new. Intellectual property establishes a commercial bias in favour of the newest varieties and, to meet the criteria for PVR.[44]

---

regulations or firm credit schemes sometimes force the adoption of specific plant varieties or even whole new crops. In other cases, farm communities enthusiastically adopt what they regard to be improved seeds. In any of these cases, commercial agriculture tends to increase genetic uniformity and this, in turn, leads to genetic erosion. Intellectual property systems (patent and PVR) encourage commercial agriculture and may accelerate genetic erosion. Biotechnology research focuses on commercial agriculture and leads to demand for IP protection with the same potentially negative consequences for genetic diversity."

[42]See Chapter 2 for more details.

[43]Duvick of Pioneer Hi-Bred and Blixt of the Weibullsholm Plant Breeding Institute, amongst other people, expressed concern regarding this issue. (Mooney, P.R. *Seeds of the Earth: A Private or Public Resource?*, Canadian Council for International Co-operation, Ottawa, Canada, 1979, p. 68.)

[44]*People, Plants, and Patents: The Impact of Intellectual Property on Biodiversity, Conservation, Trade, and Rural Society*, International Development Research Centre, Ottawa, Canada, 1994, p.17.

7.3.3. Does PVR protection cause environmental harm?

Some commentators believe claims that PVR protection will damage the environment are inaccurate and misleading.[45] Even though PVR protection has long been accused of causing environmental harm, there is no conclusive evidence about the environmental effects of PVR protection. Nor has any empirical study been carried out, because of its considerable cost, length, and impracticality. The lack of conclusive evidence casts doubt on the possibility of PVR's environmental effects. It is possible that the concerns of environmentalists result from undue protectionism or overreaction, in the sense that they jump to the conclusion that the protection would pose the environmental risk without any conclusive evidence to support their argument. It is understandable and sensible that any damage should be prevented rather than allowed to take place and eliminated later. Certain harm is incurable, in particular environmental harm. Accordingly, environmental concerns should be weighed with great care.

7.3.3.1. Will PVR protection enhance the release of new plant varieties in Thailand?

PVR does not entitle a breeder to exploit his protected variety.[46] The belief that PVR automatically entitles the right proprietor to commercially exploit his

---

[45]FAO International Board for Plant Genetic Resources states: "The various arguments which have been advanced by the opponents of plant breeders' rights have been criticised as containing factual and technical errors that can do nothing but mislead." (FAO International Board for Plant Genetic Resources, 1981; cited in Dworkin, G. "The Plant Varieties Act 1983" [1983] European Intellectual Property Review 270, at 270.)

[46]See Chapter 2 for the nature of PVR.

protected variety rests on a misunderstanding of intellectual property rights. The exploitation of certain protected property (even by their proprietors) is subject to some regulations, particularly regulatory arrangements of commodity safety; for example, in the USA, the commercialisation of food can be carried out only with the consent of the Food and Drug Administration (FDA). In some countries, such as Germany, the UK and the US, the release of GMOs is subject to certain regulations.[47]

In Thailand environmental issues have been raised in a number of fora. The environmental plan has become part of the Seventh National Economic and Social Development Plan (1992-1996). However, this concern has not been transformed into serious action. In particular, environmental concern about the release of man-made living organisms has not been taken seriously by the public. This concern is

---

[47]In Germany, the use and production of GMOs can be carried out only with a licence under the 1990 Biotechnology Act. (*International Environment Law and Regulation,* Issue 0, 1991, p. Ger-15)

In the UK, the release of GMOs is subject to the 1992 Genetically Modified Organisms (Contained Use) Regulations which come under the 1990 Environmental Protection Act. The Regulations require that anyone intending to release or market GMOs has to obtain a consent from the Department of Environment. It is an offence to import, acquire, keep or release certain GMOs without consent. (*Advisory Committee on Genetic Modification Newsletter,* January 1993.)

In the US, the release of genetically engineered plants requires approval from the NIH Recombinant DNA Advisory Committee (RAC). (Barton, J.H. *Regulatory/ Patent Issues for the Rockefeller Foundation's International Program on Rice Biotechnology,* A study conducted under Rockefeller Grant RF 88003 # 20)

In France, the use of recombinant DNA technique must be reported to the Ministry of Research and Higher Education. (Newmark, P. "Discord and Harmony in Europe" [December 1987] 5 BIO/TECHNOLOGY 1281)

discussed only amongst academic groups whereas the public are not aware of any possible harm.[48]

Despite protracted discussion, no biosafety regulation has been introduced. Anyone is free to release GMOs into the environment in Thailand; nevertheless, the commercialisation of certain products is subject to certain regulations, such as Food and Drug Administration (FDA) regulations. The commercialisation of plant varieties and seeds is not subject to the FDA regulation since they are not regarded as food or drugs. The only environmental control regulation for plant varieties and seed is the 1964 Plant Quarantine Act which provides that the importation of prohibited and restricted plants into the country must be approved by a plant quarantine officer.[49] A plant quarantine officer has no power to intervene in the field trial of hybrids resulting from the crossing of imported prohibited or restricted

---

[48]The main reasons are:

(1) Ignorance of potential danger. The public do not know, for instance, what a genetically engineered organism is or how it causes harm to the environment or how this harm may affect them.

(2) The wide spread of more serious environmental problems which affect the daily life of the public, such as traffic congestion or pollution. The potential danger from the release of man made organisms has not become apparent in the country.

[49]Section 8 of the Act provides that no person shall import or bring in transit any prohibited materials unless permission has been obtained from the Director-General of the Department of Agriculture, and the material shall be accompanied by a phytosanitary certificate issued by the competent authority of the exporting country, or in cases of countries where no such certificate is issued, by other reliable documents, and in the case of the importation the Director-General may give permission only for the purpose of experimentation or research. Prohibited varieties include rice, para-rubber, lime, coconut and cassava. Restricted varieties are, for example, citrus, sugar cane, coffee, pineapple, tobacco, cotton, cocoa, potato, maize, banana, wheat, sorghum, and orchid.

plants with other plants. The lack of legal control on the release of locally bred varieties poses the main threat to the environment.

Moreover, PVR protection does not play any active role in the commercial decision whether or not to invest in plant breeding.[50] Empirical studies reveal that PVR protection is by no mean an incentive for invention and innovation in the field of plant breeding. Existing intellectual property protection does not have any influence on investment in plant breeding and seed production in seed industries in Thailand and PVR protection is unlikely to remedy that. Furthermore, the history of Thai seed industries reveals that new plant varieties have been introduced to farmers despite the absence of PVR protection. The release of new or improved varieties is anticipated to continue and increase because of the government promotional programmes to encourage farmers to use new improved varieties and a rising demand for seeds of improved varieties. For this reason, the introduction of PVR protection will not change this situation.

7.3.3.2. Will PVR protection increase biodiversity erosion in Thailand?

The notion that PVR protection contributes to the erosion of biodiversity has been attacked by some experts.[51] An interesting argument is that the number of

---

[50]See Chapter 6 for more details.

[51]See, for example, the personal view of the UPOV Director-Counsellor (Mr. André Heitz) in the *Seminar on the Nature of and Rationale for the Protection of Plant Varieties under the UPOV Convention* organised by the International Union for the Protection of New Varieties of Plants in cooperation with the Secretariat of Agriculture, Livestock and Fisheries of Argentina and with the assistance of the Ministry of Agriculture, Fisheries and Food of Spain, Buenos Aires, November 1991.

commercial plant varieties is very small (and it becomes smaller in the case of plant varieties eligible for PVR protection), compared to entire varieties existing in the world. There are millions of species of plants on earth; but only a handful (approximately 1.4 million) are known to humans. Amongst these known varieties, very few are cultivated species; fifteen species or groups of species (banana, barley, bean, cassava, coconut, maize, peanut, potato, rice, sorghum, soybean, sugar beet, sugar cane, wheat and yam) supply more than three quarters of world resources.[52] Compared to the number of all plant species, the amount of varieties eligible for the protection is minimal, analogous to a drop in the ocean. Therefore, PVR protection is claimed not to affect the erosion of plant species in the world. However, this argument seems to miss the point since dangers from the erosion may be apparent in only few plant varieties. As can be seen from several past

---

Siebeck states: "Defenders of PVR have responded with the following arguments: (a) The risk of widespread use of a single variety predated PVR, being primarily associated with the high-yielding varieties developed during the 'Green Revolution' and in the international breeding centres; (b) The problems linked to PVR can also be found in countries that do not provide PVR; and (c) The greater competition possible under PVR may enhance diversity as firms attempt to distinguish their products from competitors. (The preceding arguments are presented in Brown, 1988; Juma and Ojwang, 1989). That is, there is little evidence to suggest that PVRs have more than a very peripheral role in declining genetic diversity (Dias, undated)." (Siebeck, W.E. et al. *Strengthening Protection of Intellectual Property in Developing Countries: A Survey of the Literature,* World Bank, Washington D.C., 1990, p. 63.)

[52]Gay, J.P. *Fabuleux maïs - histoire et avenir d'une plante,* Association générale (française) des producteurs de maïs ed., 1984, 293pp; cited in Heitz, A. "Plant Genetic Resources and Plant Breeders' Rights" in *Seminar on the Nature of and Rationale for the Protection of Plant Varieties under the UPOV Convention* organised by the International Union for the Protection of New Varieties of Plants in cooperation with the Secretariat of Agriculture, Livestock and Fisheries of Argentina and with the assistance of the Ministry of Agriculture, Fisheries and Food of Spain, Buenos Aires, November 1991.

incidents, e.g. the 1840s Irish Potato Famine[53], uniformity in one variety results in serious economic and social losses. At this point, it must be asked why uniformity has long been one of the major aims in plant breeding despite the possible undesirable consequences and whether plant breeders develop uniform varieties primarily to get PVR protection. The answer seems to be negative, as the discussion in Chapter 6 suggests that PVR protection is not an influential determinant for plant breeding direction. Two possible reasons behind the desire for uniformity in plant varieties are:

(1) Practicality in agricultural and harvesting practices.[54] Crop management[55] of one variety is much easier and more economic than that of several varieties. In particular, the current agricultural and harvesting practices depend on mechanical tools, such as tractors. Farmers do not plant several varieties of one species in one field (except the so called "combination farming" in which more than one species of plants are grown together, as the different species benefit each other). In fact, selection of plants with desirable quality has been a long agricultural practice before PVR protection was introduced. This practice leads to monoculture

---

[53]English explorers returned from the Caribbean coast in the 16th century with one variety of potato. This variety was planted everywhere in Northern Europe. In Ireland, all genetically-uniform potatoes were damaged by blight and such potato damage resulted in the death of two million with two million more searching for a new life in other countries. (Mooney, P.R. *Seeds of the Earth: A Private or Public Resource?*, Canadian Council for International Co-operation, Ottawa, Canada, 1979, p. 12)

[54]The FAO submits that the spread of modern commercial agriculture is the main cause of the current gigantic loss of diversity. More than 80 countries report that a wide range of locally grown varieties are being replaced by a few profitable alternatives from abroad. Seeds, instead of being cultivated by peasant farmers, are being supplied in bulk by multinational companies such as Pioneer, Sandoz and ICI. (Edwards, R. "Tomorrow's Bitter Harvest" [1996] 151 New Scientist 14)

[55]Crop management involves several processes, including soil preparation, sowing, watering and feeding regimes, pest and disease control, crop rotation, harvesting.

farming.[56] Therefore, the real cause of diversity erosion is the farmers' demand for uniform plant varieties.[57]

(2) Consumer demand. Consumers can be both industrial and end users. In many countries, agricultural products are sold to agro-industries for food and feed processing. Even though there is no estimation of the use of agricultural products by agro-industries in Thailand, the amount is believed to be considerable since the country is one of the major exporters of agro-industrial products.

2.1. Industrial consumers: Food industries use agricultural products as major raw material. Such agricultural products must be suitable for mechanical food processing, such as cleaning, trimming and cooking. For example, as revealed in the 1972 report of the US National Academy of Sciences, vegetable processors ordinarily determined varieties to be planted and insisted on varieties tailored to suit their particular combination of requirements;[58] or a vine variety of Muscat has

---

[56]Goodfield states: "The very success of our agriculture in designing crops with important single traits, however, has meant that over the last five to ten years, farmers all over the world have been planting more and more of the improved varieties of crop plants. These are monocultures, forms from which the variability has been bred out. The traditionally genetically diverse crops are being planted less and less, causing our store of natural variability to be rapidly depleted and irrevocably lost." (Goodfield, J. *Playing God: Genetic Engineering and the Manipulation of Life*, Sphere Books, London, 1978, pp. 48-49.)

[57]It was reported in 1985 that in the US 250 varieties of wheat were available, but only 10 of them were in common use. (Doyle "Biotechnology Research and Agricultural Stability" [1985] 2 Issues in Science and Technology 111, at 120; cited in Straus, J. "The Principle of Dependence under Patents and Plant Breeders' Rights" [1987] 12 Industrial Property 433, at 437.) It will be surprising to see industries who are interested in production and commercialisation of the remaining 240 varieties.

[58]Mooney, P.R. *Seeds of the Earth: A Private or Public Resource?*, Canadian Council for International Co-operation, Ottawa, Canada, 1979, p. 82.

Also see Frey, J.K. *Plant Breeding*, Symposium held at Iowa State University, Iowa State University Press, Iowa, 1967, p. 42. Peterson, C.E. states: "An important achievement in vegetable breeding has been the development of varieties that are suitable for mechanical

been widely grown in France because its grapes are suitable for production of quality red wine. This demand is increasingly important in many countries, particularly Thailand where agro-industries make a major contribution to the country's economic development.[59]

2.2. End users: Most consumers expect their foodstuff to be of uniform size, colour, texture and other characteristics. Such uniformity results from the single variety. For instance, consumers in Thailand tend to purchase only lychees of a variety "Emperor".

Furthermore, there is no present evidence that PVR protection is especially, or at all, to blame for the loss of plant genetic resources or genetic diversity in the developing world.[60]

Accordingly, there is no justification for the suggestion that PVR protection increases biodiversity erosion. PVR legislation seems to have become the scapegoat in a conflict between environmentalists, politicians and lawyers.

---

harvesting and processing. Examples are pea varieties with uniform maturity, sweet corn hybrids which permit mechanical harvesting and removal of kernels from the cob, and stringless green beans with characteristics necessary for the snipping and cutting machines."

[59]See "The future direction of plant breeding activities in Thailand" in Chapter 3.

[60]Byrne, N. "Plant Breeding and the UPOV" [1993] 2 Review of European Community and International Environmental Law 136, at 140.

Conclusion

PVR, as part of intellectual property, is regarded as personal property; nevertheless, its effects are not necessarily confined to the owners of protected varieties. The public interest aspects of PVR protection must not be disregarded.

The greatest concern is that PVR protection will lead to an increase in seed price by monopoly created by the exercise of the right. However, no empirical study can produce conclusive evidence supporting this concern. Furthermore, some commentators have suggested that PVR protection is not strong enough to create monopoly. Most importantly, seed pricing in Thailand is statutorily controlled.

The effect of PVR protection on technological development has in many countries been the subject of political and economic controversy. PVR supporters take a view that the protection will encourage the inward flow of overseas varieties, whereas some sceptics express concern that the protection will hinder access to and use of protected varieties. To date there is no report that access to foreign varieties by Thai seed companies has been refused by their foreign parent firms and technology associates. The presence of the protection will not improve this activity. Because access to protected varieties between seed companies in Thailand is restricted, PVR protection is in this respect irrelevant.

In recent years, environmental issues have attracted interest from not only academic experts but also other groups, e.g. politicians and the public. The effects of PVR on the environment inevitably have been the subject of controversy amongst environmentalists. The protection has been accused of hastening certain environmental disasters, as a result of the release of new living organisms and

biodiversity erosion. On balance, it appears that these accusations seem to be unjustified.

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS

8.1. Conclusions

This thesis began with the question whether Thailand would benefit from the introduction of PVR protection. The investigation shows that PVR protection is unlikely to secure an increase in foreign investment, which is the major economic interest of commercial plant breeding and seed production in Thailand. Commercial plant breeding and seed production are dominated by multinational seed companies, through which the Thai government has a clear policy of encouraging foreign investment. Seed companies in Thailand seem no to consider existing intellectual property protection as an influential investment-determinant. The history and current status of plant breeding and seed production in Thailand is not indicative of the need for PVR protection or any equivalent form of protection. This is due to the absence of counterfeiting in plant breeding and seed production, which results from the complicated and costly nature of plant breeding and seed production, the consumer's behaviour and the channels of seed distribution in Thailand.

Conversely, the fear that the protection will have undesirable effects on public interests appears unfounded. The greatest concern is that monopolistic power created by the exercise of PVR will cause a rise in seed prices. However, seed pricing in Thailand is statutorily controlled. PVR protection is also accused of hastening environmental danger, e.g. encouraging the release of new varieties to the environment and loss of biodiversity. No conclusive evidence supports these accusations and some commentators criticise them as inaccurate and misleading.

The effects of PVR protection on technological development are seen as positive and negative. It is claimed that PVR will increase inward flow of new varieties from abroad. On the contrary, some critics believe that it will obstruct access to plant materials of protected varieties. At present, most foreign varieties are sent to Thailand through multinational seed firms. The absence of PVR protection does not discourage the inward flow of new varieties from abroad. The concern on the negative effect of PVR protection is unwarranted. A PVR system based on either the 1978 or 1991 UPOV text has a provision on free access and use of plant material of protected varieties. Furthermore, access to plant material of commercially successful varieties in Thailand is severely restricted.

Thailand can, however, expect indirect economic benefits from the introduction of PVR protection, provided that it fully implements the TRIPs agreement and other multilateral trade agreements annexed to the WTO agreement. As a *quid pro quo* for full compliance with WTO obligations, Thailand can benefit from growing access to foreign markets through tariff reduction under the WTO trade liberalisation. This will encourage wild economic development in Thailand.

8.2. Recommendations

Political commitments under the TRIPs agreement as well as economic pressures and incentives under the WTO agreement, have forced the Thai government to introduce legal protection for plant varieties. The TRIPs agreement requires Thailand to provide protection by one of three legal forms: patent protection, an effective *sui generis* system, or any combination thereof. What is the most appropriate PVR system for Thailand? The absence of any specific reference to PVR in TRIPs means that Thailand has a relatively free choice. Provided it

constitutes an effective system, Thailand can avoid allegations of TRIPs infringement. The two main contenders are the 1978 UPOV system and the stronger 1991 UPOV system, both of which are internationally approved and established. Since PVR protection or any equivalent form of protection will not bring any economic benefit to commercial plant breeding and seed production in Thailand, the government should consider adopting a PVR system that offers the minimum-level protection. Of the two UPOV texts, a system based on the 1978 Convention is adequate for the purpose. If stronger protection subsequently proves necessary and beneficial for the development of commercial plant breeding and seed production, the government may consider a system based on the 1991 UPOV text or even a patent system.

There should be a farmer's exemption (based on the 1991 UPOV text) in PVR legislation in order to ensure that farmers are entitled to continue their traditional practice of seed saving, particularly of rice. The exemption should be confined, within reasonable limits, to use on-farm of seed harvested by the farmer on his farm, in order to safeguard the legitimate interests of breeders.

Although it is suggested that PVR protection will have little or no effect on the environment, in order to avoid any possible conflict with environmentalists, a provision on biosafety should be incorporated into the legislation.[1] An application for PVR may be refused (or PVR may be revoked) if it is evident that the

---

[1]This provision is also found in Article 13 (8) of the Council Regulation (EC) No. 2100/94 of 27 July 1994 on Community plant variety rights which provides that the exercise of the rights conferred by Community plant variety rights may not violate any provisions adopted on the grounds of public morality, public policy or public security, the protection of health and life of humans, animals or plants, the protection of the environment, the protection of industrial or commercial property, or the safeguarding of competition, of trade or of agricultural production.

commercial exploitation of the applied for variety (or the protected variety) will harm the environment.[2]

There should be an administrative body called "Plant Variety Protection Office" (PVPO) and this should be subordinate to the Department of Agriculture, in order to take advantage of the Department's political and technological strength.[3] The Office should implement the system under the advice of a Plant Variety Protection Board whose members are selected from various interested groups from both public and private sectors. The membership should include the General Director of Agriculture (chairman), the General Director of Intellectual Property (vice chairman)[4], representatives from Thailand's Plant Breeding Association, seed companies, farmers, the National Centre for Genetic Engineering and Biotechnology, and other governmental organisations. The Board appoints the Commissioner of PVPO who has the authority to decide the granting of PVR. The Board advises the Commissioner on the adoption of rules and regulations to facilitate that administration of this legislation, and makes advisory decisions on all appeals from a PVR examiner.

---

[2]This provision is in line with Article 27 (2) of the TRIPs agreement: "Members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect *ordre public* or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by their law."

[3]It has been reported that the Thai cabinet is likely to place the PVPO under the responsibility of the Department of Agriculture. The Deputy Minister of Agriculture has played an active role in drafting and legislating PVR protection and he holds political strength in the present government.

[4]The General Director of Intellectual Property can use his expertise of intellectual property protection to make advice with regard to this aspect.

PVR should be granted on the basis of evidence supplied by a PVR applicant that the applied for variety meets the requirements for a grant of PVR. Because of current governmental budgetary constraints, it is anticipated that the financial resources allocated to the PVPO are insufficient for the Office to carry out DUS technical examinations. Therefore, a PVR applicant should be responsible for the entire cost of carrying out the technical test.

An applicant should be required to submit the result of a DUS technical test carried out by an organisation appointed by the PVPO. At present, a number of research institutes in Thailand are capable of conducting DUS technical assessment. They include universities and research stations of the Department of Agriculture which are located throughout the country. These organisations in different regions should be responsible for the technical examination of plant varieties which are indigenous to such areas. The test should be conducted under DUS test guidelines issued by the PVPO (by adopting the UPOV test guidelines).

If the Commissioner is satisfied that PVR ought to be granted, he should, on payment of the granting fee, enter into a Register the new variety and make the grant by issuing a Certificate of Registration.

A PVR holder should be in a position, throughout the term of protection, to furnish at the Commissioner's request, propagating material of the protected variety and to satisfy the Commissioner that the propagating material is being maintained. The propagating material should be deposited and replenished periodically in a public repository appointed by the PVPO. At present, competent governmental organisations include the Plant Germplasm Centre of Kasetsart University, the Thailand Institute for Science and Technology Research, the

National Centre for Genetic Engineering and Biotechnology and the Department of Agriculture. A PVR holder bears the cost of the deposit.

Dispute proceeding with regard to PVR infringement should be brought before, and decided by, the Intellectual Property and International Trade Court. A panel of judges should comprise three members, one of whom is an associate judge who is well equipped with scientific and legal aspects of PVR. An associated judge can use his expertise to assist other judges to tackle technical aspects of PVR.

Finally, the government should not rush to legislate for PVR protection. Thailand is not compelled to introduce the protection until the year 2005, and the government should use this period of grace to train personnel, establish cooperation with governmental organisations appointed to carry out DUS technical examinations, and put in place the infrastructure necessary for the smooth running of the chosen system. The government should also seek technical and financial assistance from developed countries, as provided under Article 67 of the TRIPs agreement.

BIBLIOGRAPHY

Books

Allard, R.W. *Principles of Plant Breeding,* John Wiley & Sons, New York, USA. 1960.

Becker, W.M. et al. *The World of the Cells,* 2nd ed., Benjamin/ Cummings, California, USA, 1991.

Beier, F-K, et al. (eds.) *From GATT to TRIPs - The Agreement on Trade-Related Aspects of Intellectual Property Rights,* Max Planck Institute for Foreign and International Patent, Copyright and Competition Law, Munich, 1996.

Bent, S.A. et al. *Intellectual Property Rights in Biotechnology Worldwide,* Stockton Press, New York, 1987.

Brown, T.A. *Genetics: A Molecular Approach* ,2nd ed., Chapman & Hall, London, 1992.

Burke, J. (ed.) *Jowitt's Dictionary of English Law,* Vol. 1, Sweet & Maxwell, London, 1977.

Burns, G.W. et al. *The Science of Genetics,* 6th ed., MacMillan, New York, USA, 1989.

Byrne, N. *Negotiatings & Drafting Technology Licensing Agreements,* MacMillan, London, 1994.

Cornish, W.R. *Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights,* 3rd ed., Sweet & Maxwell, London, 1996.

De Robertis, E.D.P. et al. *Cell and Molecular Biology,* 8th ed., Lea & Febiger, Philadelphia, USA, 1987.

Fenby, J. *Piracy and the Public: Forgery, Theft and Exploitation,* Frederick Muller, London, 1983.

Freeman, C. *The Economics of Industrial Innovation,* Frances Printer, London, 1982.

Gardner, E.J. *Principles of Genetics,* 8th ed., Wiley & Sons, New York, 1991.

Goodfield, J. *Playing God: Genetic Engineering and the Manipulation of Life,* Sphere Books, London, 1978.

Gregg, B. *Seed: Conditioning, Storage and Marketing,* Department of Agricultural Extension, Thailand, 1983.

Griffui, K. *The Political Economy of Agrarian Change: An Essay on the Green Revolution,* MacMillan Press, London, 1974.

Hanauer, E.R. *Biology Made Simple,* W.H. Allen, London, 1980.

Hartl, D.J. *Basic Genetics*, 2nd ed., Jones and Bartlett, Boston, USA, 1991.

Heiser, C.B. (Jr.), *Seed to Civilisation,* 2nd ed., W.H. Freeman, San Francisco, USA, 1981.

Impacts of Applied Genetics: Micro-organisms, Plants and Animals, United States Office of Technology Assessment, USA, 1981.

Intellectual Property Rights Associated with Plants, ASA Special Publication No. 52, Crop Science Society of American, et al., Madison, USA, 1989.

Johnston, A. et al. *New Technologies and Development,* United Nations, Paris, 1986.

Kennedy, P. *Preparing for the Twenty-First Century,* Harper Collins Publishers, London, 1993.

King, R.C. *A Dictionary of Genetics,* 4th ed., Oxford University Press, Oxford, 1990.

Kingston, W. *Innovation, Creativity and Law,* Kluwer Academic Publishers, Dordrecht, Netherlands, 1990.

Klopperburg, J.R. (Jr.), *First the Seed: The Political Economy of Plant Biotechnology 1492-2000,* Cambridge University Press, Cambridge, 1988.

Ladas, S.P. *Patents, Trademarks, and Related Rights, National and International Protection,* Vol. 1, Harvard University Press, Cambridge, Massachusetts, USA, 1975.

Lal, D. *Appraising Foreign Investment in Developing Countries,* Heinemann, London, 1975.

Lawrence, E. (ed.) *Henderson's Dictionary of Biological Terms,* Longman, London, 1995.

Lawrence, W.J.C. *Plant Breeding*, Institute of Biology's Studies in Biology No. 12, Edward Arnold, Ames, Iowa, USA, 1966.

Lipsey, R.G. *An Introduction to Positive Economics,* 5th ed., Weidenfeld and Nicolson, London, 1979.

Marx, J.L. *A Revolution in Biotechnology,* Cambridge University Press, Cambridge, 1989.

Maunder, P. (ed.) *The British Economy in the 1970s,* Heinemann Educational Books, London, 1980.

Mauseth, J.D. *An Introduction to Plant Biology,* Saunders College Publishing. Philadelphia, USA, 1991.

Momberg, D. et al. *Strategy in the Use of Intellectual Property: A Guide to Managing Business' Most Valuable Asset,* Gerundive Press, Hong Kong, 1986.

Moo-Young, M. *Comprehensive in Industrial, Agriculture and Medicine, Vol 1 (The Principles of Biotechnology: Scientific Fundamentals),* Pergamon Press, Oxford, 1985.

Mooney, P.R. *Seed of the Earth: A Private or Public Resource?*, Canadian Council for International Co-operation, Ottawa, Canada, 1979.

Nevin, E. *Textbook of Economic Analysis,* 5th ed., MacMillan, London, 1985.

North, C. *Plant Breeding and Genetics in Horticulture,* MacMillan, London. 1979.

Persley, G.J. *Beyond Mendel's Garden: Biotechnology in the Service of World Agriculture,* CAB International, Oxford, 1990.

Pescatore, P. et al. *Handbook of WTO/GATT Dispute Settlement,* Vol. 1, Transnational Juris Publications, New York, USA, 1995.

Phillips, J. et al. *Introduction to Intellectual Property Law,* 3rd ed., Butterworths, London, 1995.

Porges, A. et al. *GATT, Analytical Index: Guide to GATT Law and Practice,* 6th ed., Geneva, Switzerland, 1994.

Robinson, D. *Introduction to Economics,* ICSA Publishing, Cambridge, 1986.

Smith, G.V. et al. *Valuation of Intellectual Property and Intangible Assets,* John Wiley & Sons, New York, 1989.

Stafford, A. et al. *Plant Cell and Tissue Culture,* Open University Press, Milton Keynes, 1991.

Stewart, T.P. (ed.) *The GATT Uruguay Round: A Negotiating History (1986-1992),* Vol. II: Commentary, Kluwer, Deventer, Netherlands, 1993.

Stryer, L. *Biochemistry,* 3rd ed., W.H. Freeman, New York, USA, 1988.

Stubbs, R. et al. (eds.) *Political Economy and the Changing Global Order,* MacMillan, London, 1994.

Thomson, J.R. *An Introduction to Seed Technology,* Thomson Litho, Scotland, 1979.

Trevan, M.D. et al. *Biotechnology: The Biological Principles,* Open University Press, Milton Keynes, 1987.

Weaver, R.F. et al. *Genetics,* 2nd ed., Wm C Brown Publishers, Dubuque, USA, 1992.

World Intellectual Property Organisation, *Introduction to Intellectual Property Theory and Practice,* Kluwer Law International, London, 1997.

Journal articles

"Alerts and Update: Thailand: Patent Law Amendments: US Pressure" [February 1991] IP Asia 21.

[1992] 9 Asean Journal on Science & Technology for Development 1.

Barton, J.H. "The International Breeder's Right System and Crop Plant Improvement" [June 1982] 216 Science 1071.

Beaumont, P. "Release of Genetically Modified Organisms" [1993] 2 Review of European Community & International Environmental Law 182.

[1993] 11 BIO/TECHNOLOGY 1559.

Blakeney, M. "The Impact of the TRIPs Agreement in the Asia Pacific Region" [1996] 10 European Intellectual Property Review 544.

Burdet, H.M. "The De Candolle Family and the Historical Development of Botanical Nomenclature" [1984] 40 Plant Variety Protection 3.

Byrne, N. "Plant Breeding and the UPOV" [1993] 2 Review of European Community and International Environmental Law 136.

Chantikul, K. "Investment Promotion Laws" [1984] 3 Chulalongkorn Law Review 97.

Claffey, B. "Patenting Life Forms: Issue Surrounding the Plant Variety Protection Act" [December 1981] 13 Southern Journal of Agricultural Economics 29.

"Consultations: the First Stage in Settlement of Disputes" [1995] 3 Focus 2.

"Copyright Law May Drive Japanese On-line Companies Overseas" [September 1997] 9 Journal of Proprietary Rights 22.

Correa, C.M. "The GATT Agreement on Trade-Related Aspects of Intellectual Property Rights: New Standards for Patent Protection" [1994] 8 European Intellectual Property Review 32.

D'Iorio, H. et al. "Plant Breeders' Rights - Practical Considerations" [1995] 11 Canadian Intellectual Property Review 277.

Dunning, J. "Toward an Eclectic Theory of International Production: Some Empirical Tests" [Spring/ Summer 1980] Journal of International Business Studies 9.

Dworkin, G. "The Plant Varieties Act 1983 [1983] 10 European Intellectual Property Review 270.

Edwards, R. "Tomorrow's Bitter Harvest" [1996] 151 New Scientist 14.

Evan, G.E. "Intellectual Property as a Trade Issue: The Making of the Agreement on Trade-Related Aspects of Intellectual Property Rights" [1994] 18 World Competition Law and Review 137.

Evan, G.E. "The Principle of National Treatment and the International Protection of Industrial Property" [1996] 3 European Intellectual Property Review 149.

"First Review of Intellectual Property Laws Completed" [1997] 25 Focus 6.

Gardiner, R. "Language and the Law of Patents" [1994] 47 Current Legal Problems 255.

[1996] 151 New Scientist 8.

"GATT - the Intellectual Property Dimension"[1989] 1 Intellectual Property in Business 2.

Hannah, L. et al. "Global Priorities" [1995] 45 BioScience 122.

Hudec, R.E. "A Statistical Profile of GATT Dispute Settlement Cases" [1993] 2 Minnesota Journal of Global Trade 1.

Hughes, J. "The Philosophy of Intellectual Property" [1988-89] 77 Georgetown Law Journal 290.

"India Loses Ground in Patent Dispute with US" [September 1997] Journal of Proprietary Rights 20.

"Industrial Property and Plant Breeders' Rights" [1985] 45 Plant Variety Protection 14.

Ko, Y. "An Economic Analysis of Biotechnology Patent Protection" [December 1992] 102 Yale Law Journal 777.

Kunhardt, H. "UPOV and Variety Denomination" [1984] 40 Plant Variety Protection 16.

Kusardy, R. "The Need for a Regional Patent Organisation in South-East Asia" [1985] 7 World Patent Information 264.

Naumann, M. et al. "Grand Hopes for New Court" [November 1996] 9 IP Asia 32.

Nijar, G.S. et al. "Intellectual Property Rights: the Threat to Farmers and Biodiversity" [1994] 39 Third World Resurgence 35.

Periera, T. et al. "Thailand: Protection for Pharmaceuticals" [October 1989] 6 IP Asia 4.

Prima Braga, C.A. "The Economics of Intellectual Property Rights and the GATT: A View from the South" 22 [1989] Vanderbilt Journal of Transnational Law 244.

Royon, R. "Variety Denominations and Trademarks" [1984] 40 Plant Variety Protection 26.

Ruttan, V. "Changing Role of Public and Private Sectors in Agricultural Research" [April 1982] 216 Science 23.

Seyoum, B. "The Impact of Intellectual Property Rights on Foreign Direct Investment" [Spring 1996] Columbia Journal of World Business 51.

Sherwood, R. "Intellectual Property Systems and Investment Stimulation: The Rating of Systems in Eighteen Developing Countries" [1997] 37 IDEA 261.

Slaughter, J. "TRIPs: the GATT Intellectual Property Negotiations Approach their Conclusion" [1990] 11 European Intellectual Property Review 418.

Smartt, J. "Biological Problems in Meeting DUS Standards for Plant Variety Rights Registration" [1985] Plant Variety Protection 28.

Somwaiya, K. "Intellectual Property and International Trade Court Bill" [October 1994] 8 IP Asia 30.

Stamm, O.A. "GATT Negotiations for the Protection of New Technologies" [1991] 73 Journal of the Patent & Trademark Office Society 680.

Straus, J. "The Principle of Dependence under Patents and Plant Breeders' Rights" [1987] 12 Industrial Property 433.

"Thailand and the Philippines Promise Piracy Crackdowns" [July 1997] 9 Journal of Proprietary Rights 24.

"Thailand: US Renews Call for Better Patent Protection" [January 1988] 1 IP Asia 17.

"USTR Release Special 301 Lists and Initiates WTO Proceedings" [July 1997] 9 Journal of Proprietary Rights 23.

Valiante, M.A. "Biotechnology and the Environment: A Regulatory Proposal" [1985] Osgoode Hall Law Journal 359.

Verma, S.K. "TRIPs and Plant Variety Protection in Developing Countries" [1995] 6 European Intellectual Property Review 281.

Cases

Asgrow Seed Co v. *Winterboer* 33 USPQ2d 1430.

Case 837/2507 (Thai Supreme Court).

Case 386/2509 (Thai Supreme Court).

Case 353/2510 (Thai Supreme Court).

Germinal Holdings Ltd v. *H.R. Fell & Sons Ltd* [1993] Fleet Street Reports 434.

Hybrid plants/ LUBRIZOL [1990] 3 Official Journal of the European Patent Office 71.

Jefferson Parish Hospital District No. 2 v. *Hyde* (1984) US 2 (United States Supreme Court).

Maris Druid Spring Barley [1968] Fleet Street Reports 559.

National Provincial Bank v. *Ainsworth* [1965] Appeal Cases 1175 (House of Lords).

Pioneer Hi-Bred International v. *Holden Foundation Seeds Inc* 31 USPQ2d 1385.

PLANT GENETIC SYSTEMS/ Glutamine synthetase inhibitors [1995] European Patent Office Report 357.

Public Varieties of Mississippi Inc v. *Sun Valley Seed Co* 14 USPQ2d 2055.

Re Zephyr - Spring Barley [1967] Fleet Street Reports 576.

Smith v. *Channel Inc* (1968) 402 F2d 562.

Newspapers

Bangkok Post, 27th November 1987.

Bangkok Post, 13th December 1990.

Bangkok Post, 12th January 1991.

Bangkok Post, 14th January 1991.

Guardian, 17th January 1998.

Prachachart Turakit, No. 2551 (1751), 26th - 29th June 1994.

The Nation, 11th January 1991.

The Nation, 12th January 1991.

The Nation, 6th January 1997.

Legislation and Conventions

Agreement on Trade-Related Aspects of Intellectual Property Rights.

Agreement Establishing the World Trade Organisation.

International Convention for the Protection of New Varieties of Plants, 1978.

International Convention for the Protection of New Varieties of Plants, 1991.

Thai Act for the Establishment of and Procedure for Intellectual Property and International Trade Court 1996.

Thai Civil and Commercial Code 1992.

Thai Patent Act 1992.

Thai Penal Code 1956.

Thai Seed Act 1975 (revised in 1992).

Reports, proceedings, theses and other documents

Baenziger, P.S. et al. (eds.) *Intellectual Property Rights: Protection of Plant Materials,* CSSA Special Publication No. 21, sponsored by Crop Science Society of America et al., Madison, USA, 1993.

Brenner, C. *Biotechnology and Developing Country Agriculture: The Case of Maize,* Development Centre of the Organisation for Economic Co-operation and Development, France, 1991.

Butler, L.J. et al. *The Impacts of Patent Protection on the US Seed Industry and Public Plant Breeding,* North Central Region Research Publication 304, Research Division, College of Agriculture and Life Sciences, University of Wisconsin, Madison, USA, 1985.

Byrne, N. *Commentary on the Substantive Law of the 1991 UPOV Convention for the Protection of Plant Varieties,* Centre for Commercial Law Studies, Queen Mary and Westfield College, University of London, London, 1991.

Byrne, N. *Legal Protection of Plants in Australia under Patent and Plant Variety Rights Legislation,* Australian Patent Office, Australian Plant Variety Rights Office, 7th November 1990.

Byrne, N. *The Scope of Intellectual Property Protection for Plants and Other Life Forms,* Report prepared for the Common Law Institute of Intellectual Property, Intellectual Property Publishing Limited, London, 1989.

Draft Amendment to the General Agreement on Tariff and Trade on the Protection of Trade-Related Intellectual Property Rights, Communication from Switzerland, GATT Doc. No. MTN.GNG/NG11/W/73 (14th May 1990).

Draft Agreement on the Trade-Related Aspects of Intellectual Property Rights, Communication from the European Community, GATT Doc. No. MTN.GNG/NG11/W/68 (29th March 1990).

Draft Agreement on the Trade-Related Aspects of Intellectual Property Rights, Communication from the United States, GATT Doc. No. MTN.GNG/NG11/W/70 (11th May 1990).

Draft Agreement on the Trade-Related Aspects of Intellectual Property Rights. Communication from Argentina, Brazil, Chile, China, Columbia, Cuba, Egypt, India, Nigeria, Peru, Tanzania and Uruguay, GATT Doc. No. MTN.GNG/NG/11/W/71 (14th May 1990).

Draft Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations, GATT Doc. No. MTN.TNC/W/FA (20th December 1991).

Footer, M. *TRIPs and the EC,* CLIP Seminar Report, Intellectual Property Institute, London, 1995.

Foreign Trade Statistics of Thailand 1993, Thai Customs Department, Ministry of Finance, Thailand, 1993.

Frey, J.K. (ed.) *Plant Breeding,* Symposium held in Iowa State University, Iowa State University Press, Ames, Iowa, USA, 1967.

Fry, M.J. *Foreign Direct Investment in a Microeconomic Framework: Finance, Efficiency, Incentives, and Distortions,* International Economics Department, World Bank, Washington DC, 1993.

Future Potential of Biotechnology in Thailand, Thailand Development Research Institute Foundation, Thailand, 1992.

Gerstenfeld, A. *Innovation: a Study of Technological Policy,* University Press of America, Washington DC, 1979.

Guidelines Proposed by the European Community for the Negotiations on Trade-Related Aspects of Intellectual Property Rights, GATT Doc. No. MTN.GNG/NG11/W/16 (28th November 1987).

Harvey, J. et al. *The Plant Variety Testing and Seed Certification Systems in the United Kingdom,* Report to the Ministry of Agriculture, Fisheries and Food, and the Secretaries of State for Northern Ireland, Scotland and Wales, February 1988.

Heywood, V.H. (ed.) *Global Biodiversity Assessment*, published for the United Nations Environment Programme, Cambridge University Press, Cambridge, 1995.

Husain, I. et al. *Capital Flows to South Asian and ASEAN Countries,* International Economics Department, World Bank, Washington DC, 1992.

Industrial Patents and Plant Breeders' Rights - Their Proper Fields and Possibilities for their Demarcation, Records of a Symposium held on the occasion of the eighteenth ordinary session of the Council of the International Union for the Protection of New Varieties of Plants, Geneva, Switzerland, 17th October 1984.

Intellectual Property & International Trade: A Guide to the Uruguay Round TRIPs Agreement, International Chamber of Commerce, World Business Organisation, Paris, 1996.

International Union for the Protection of New Varieties of Plants, *Records of the Diplomatic Conference for the Revision of the International Convention for the Protection of New Varieties of Plants,* Geneva, Switzerland, 1991.

International Union for the Protection of New Varieties of Plants, *Revised General Introduction to the Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability of New Varieties of Plants,* revised by the Technical Committee on 14th November 1979, document C/XIV/9, reproduced from TG/1/2.

Jansen, K. *Direct Foreign Investment and Adjustment: the Case of Thailand,* Institute of Social Studies, Hague, Netherlands, August 1993.

Jaffe, W. et al. *The Impact of Plant Breeders' Rights in Developing Countries: Debate and Experience in Argentina, Chile, Columbia, Mexico and Uruguay,* Inter-American Institute for Co-operation on Agriculture, University of Amsterdam, Netherlands, February 1995 (unpublished).

Lesser, W.H. et al. *An Economic Analysis of the Plant Variety Protection Act,* American Seed Trade Association, Washington DC, 1983.

Lesser, W.H. *Valuation of Plant Variety Protection Certificates,* Department of Agricultural Economics, New York State College of Agricultural and Life Sciences, Statutory College of the State University, Cornell University, New York, June 1993.

Lim, L.Y.C. et al. *Foreign Direct Investment and Industrialisation in Malaysia, Singapore, Taiwan and Thailand,* Development Centre of the Organisation for Economic Co-operation and Development, Paris, 1991.

Llewelyn, M. *The Legal Protection of New Varieties,* PhD thesis submitted to University College of Wales, Aberystwyth, Dyfed, 29th September 1990.

Mansfield, E. *Intellectual Property Protection, Foreign Direct Investment, and Technology Transfer,* International Finance Corporation, World Bank, Washington DC, 1994.

Mansfield, E. *Intellectual Property Protection, International Finance Corporation,* Discussion Paper 19, World Bank, Washington DC. 1994.

Nijar, G.S. et al. *Intellectual Property Rights: the Threat to Farmers and Biodiversity,* Paper circulated at the Biodiversity Convention meeting of the Inter-governmental Negotiating Committee in Geneva, Switzerland, 11th-15th October 1993.

People, Plants, and Patents: The Impact of Intellectual Property on Biodiversity, Conservation, Trade, and Rural Society, International Development Research Centre, Ottawa, Canada, 1994.

Perrin, R.K. et al. *Some Effects of the U.S. Plant Variety Protection Act of 1970,* Economics Research Report No. 46, Department of Economics and Business, North Carolina State University, North Carolina, USA, August 1983.

Plant Breeders' Rights: Report of the Committee on Transactions in Seeds, Cmnd. 1092, HMSO, London, 1960.

Proposal by the Nordic Countries for the Negotiations on Standards and Principles for Trade-Related Aspects of Intellectual Property Rights, GATT Doc. No. MTN.GNG/NG11/W/36 (10th July 1989).

Organisation for Economic Cooperation and Development, *The Generalised System of Preference: Review of the First Decade,* Paris, 1983.

Seed Division Report, Department of Agricultural Extension, Thailand, 1993.

Seibeck, W.E. et al. (eds.) *Strengthening Protection of Intellectual Property in Developing Countries: a Survey of the Literature,* World Bank, Washington DC, 1990.

Seminar on the Nature of and Rationale for the Protection of Plant Varieties under the UPOV Convention, organised by the International Union for the Protection of New Varieties of Plants in cooperation with the Government of the Republic of Hungary, Budapest, Hungary, 19th-21st September 1990.

Seminar on the Nature of and Rationale for the Protection of Plant Varieties under the UPOV Convention, organised by the International Union for the Protection of New Varieties of Plants in cooperation with the Government of Japan, Tsukuba, Japan, 12th-15th November 1991.

Seminar on the Nature of and Rationale for the Protection of Plant Varieties under the UPOV Convention, organised by the International Union for the Protection of New Varieties of Plants in cooperation with the Secretariat of Agriculture, Livestock and Fisheries of Argentina and with the assistance of the Ministry of Agriculture, Fisheries and Food of Spain, Buenos Aires, November 1991.

Senate Standing Committee on National Resources, The Parliament of the Commonwealth of Australia, *Plant Variety Rights,* Australian Government Publishing Service, Canberra, Australia, 1984.

Setboonsarng, S. et al. *Seed Industry in Thailand: Structure, Conduct and Performance,* IVO Research Report No. 32, 1988.

Silberston, A. *The Importance of Patents*, Common Law Institute of Intellectual Property, London, 1987.

Sriwatanapongse, S. *Status of Development in Plant Biotechnology in Thailand,* Paper presented at ISAAA Biosafety Workshop in Bogor, Indonesia, 19th - 22 rd April 1993.

Taylor, C.T. et al. *The Economic Impact of the Patent System: A Study of the British Experience,* Cambridge University Press, Cambridge, 1873.

Thai Bar Association, *The Administration of Justice in Thailand,* Bangkok, Thailand, 1969.

Thai Seventh National Economic and Social Development Plan (1991-1996).

Thai Eighth National Economic and Social Development Plan (1997-2001).

Thailand National Report to the United Nations Conference on Environment and Development (UNCED), June 1992.

The Development of Thailand's Technological Capability in Industry. Vol. 3, Capability Development for Biotechnology-Based Industry, Vol. 6, Overview and Recommendations, Thailand Development Research Institute Foundation, Thailand, 1989.

The First Twenty-five Years of the International Convention for Protection of New Varieties of Plants, UPOV Publication No. 879(E), Geneva, Switzerland, 1987.

Thomson, P. *Trend in Thailand's Seed Sector,* Paper presented at ASIAN SEED' 94, Chiang Mai, Thailand, September 1994.

United Nations Conference on Trade and Development, *The TRIPs Agreement and Developing Countries,* United Nations, New York, 1996.

United Nations Conference on Trade and Development, *Science and Technology in the New Global Environment: Implication for Developing Countries.* United Nations, Geneva, Switzerland, 1996.

White Paper on an Approach to Industrial Strategy, Cmnd. 6315, HMSO, London, 1975.

Wierema, H. *Seed Industry Development in Developing Countries: A Survey amongst Private Seed Companies in the North,* Research Report No. 35, Development Research Institute, University of Tilburg, Netherlands, 1989.

Wijk, J.V. et al. *Intellectual Property Rights for Agricultural Biotechnology: Options and Implications for Developing Countries,* Intermediary Biotechnology Service, Netherlands, 1993.

World Investment Report 1996: Investment, Trade and International Policy Arrangement, United Nations Conference on Trade and Development, United Nations, Geneva, Switzerland, 1996.

Working Paper on Patent Law Revision, prepared for the Department of Consumer and Corporate Affairs, Ottawa, Canada, June 1976.

World Trade Organisation, *Trade and Foreign Direct Investment,* Press/57, Geneva, Switzerland, 9th October 1996.

World Wild Fund for Nature, *The Need for a Biosafety Protocol as Part of the Biodiversity Convention, A Background Paper for the First Conference of Parties to the Convention on Biological Diversity,* Nassau, Bahamas, 28th November - 9th December 1994.

Yuthavong, Y. et al. *Communication Strategies in Applied and Technical Research in Thailand,* Preliminary report of research findings, National Centre for Genetic Engineering and Biotechnology, Bangkok, Thailand, 1991.

Yuthavong, Y. et al. "Communication Strategies in Tissue Culture and Seed Research in Thailand" [1993] 28 Scientometrics 41.